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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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DARWINISM AND NATIONAL LIFE

THE Darwinian theory has a practical side of infinite importance, which has not, I think, been sufficiently considered. The process of natural selection among wild animals is of necessity extremely slow. Starting with the assumption (now no longer a mere assumption) that the creature best adapted to its local conditions must prevail over others in the struggle for existence, the final establishment of the superior type is dependent at each step upon three accidents—first, the accident of an individual sort or variety better adapted to the surrounding conditions than the then prevailing type; secondly, the accident that this superior animal escapes destruction before it has had time to transmit its qualities; and, thirdly, the accident that it breeds with another specimen good enough not to neutralise the superior qualities of its mate. In the case of domesticated animals the progress is incomparably more rapid, because it is practicable, first, to modify the conditions of life, so as to encourage the appearance of an improved specimen; next, to cherish and protect it against disaster; and, lastly, to give it a consort not altogether unworthy of the honour of reproducing its qualities. The case of man is intermediate in rapidity of progress to the other two. The development of improved qualities cannot be insured by judicious mating, because as a rule human beings are capricious enough to marry without first laying a case for opinion before Mr. Darwin. Neither would it be easy, nor, perhaps, even allowable, to extend any special protection by law or custom to those who may be physically and intellectually the finest examples of our race. Still, two things may be done: we may vary the circumstance of life by judicious legislation, and still more easily by judicious non-legislation, so as to multiply the conditions favourable to the development of a higher type; and by the same means we may also encourage, or at least abstain from discouraging, the perpetuation of the species by the most exalted individuals for the time being to be found. Parliament, being an assembly about as devoid of any scientific insight as a body of educated men could possibly be, has not as yet consciously legislated with a view to the improvement of the English type of character. Without knowing it, however, the Legislature has sometimes stumbled on the right course, though it has more often blundered into the wrong. Our free trade policy has furnished special scope and special advantages to the energetic enterprising character, and so far has tended to perpetuate and intensify the type which has given to little England her wonderful prominence in the world. On the other hand, the steady refusal to make a career for scientific men has drained away most of our highest intellect from its proper field, and has subjected the rest to an amount of discouragement by no means favourable to increase and improvement. Our laws and customs practically check the growth of the scientific mind as much as they tend to develop the speculative and energetic commercial character.

We do not expect for a long time to hear an orator in the House of Commons commence his speech by announcing, (as a distinguished member of the Austrian Reichsrath recently did, in a debate on the relation of the different nationalities in the empire), that the whole question is whether we are prepared to accept and act upon the Darwinian theory. But even an average English M.P. may be brought to see that it may be possible, indirectly, to influence the character and prosperity of our descendants by present legislation, and none will deny that, if this is practicable, a higher duty could not be cast upon those who guide the destinies of a nation.

A glance at the operation of Darwinism in the past, will best show how potent it may be made in the future. Look at English progress and English character, and consider from this point of view to what we owe it. There were originally some natural conditions favourable to the growth of our commercial and manufacturing energy. We had an extensive coast and numerous harbours. We had also abundance of iron-stone in convenient proximity to workable coal. Other nations either wanted these advantages or were ignorant that they possessed them. These favourable conditions developed in many individuals a special adaptability to commercial pursuits. The type was rapidly reproduced and continually improved until England stood, in the field of commerce, almost alone among the nations of the world. And what is there now to sustain our pre-eminence? Nothing, or next to nothing, except the type of national character, which has been thus produced. Steam, by land and sea, has largely diminished the superiority which we derived from the nature of our coast; and coal and iron are now found and worked in a multitude of countries other than our own. Our strength in commerce, like our weakness in art, now rests almost exclusively on the national character which our history has evolved.

Take another example of the character of a people produced partly by natural conditions of existence, but far more by the artificial conditions to which evil legislation has exposed it. What has made the typical Irishman what he now is? The Darwinian theory supplies the answer. Ireland is mainly an agricultural country, with supplies of mineral wealth altogether inferior to those of England, though by no means contemptible if they were but developed. This is her one natural disadvantage, and it is trifling compared with those which we in our perversity created. For a long period we ruled Ireland on the principles of persecution and bigotry, and left only two great forces at work to form the character of the people. All that there was of meanness and selfishness and falsehood was tempted to servility and apostacy, and flourished and perpetuated itself accordingly. All that there was of nobleness and heroic determination was drawn into a separate circle, where the only qualities that throve and grew were irreconcileable hatred of the oppressor and resolute but not contented endurance. The two types rapidly reproduced themselves, and as long as the external conditions remained unaltered, they absorbed year by year more and more of the people's life; as, if Darwinism is true, they could not but do. And what is the result now? A great part of a century has elapsed since we abandoned the wretched penal laws, and yet none can fail to see in Ireland the two prevailing types of character which our ancestors artificially produced, the only change being that the two types have become, to a certain extent, amalgamated in a cross which reflects the peculiarities of each. Whether future legislation may so far modify the conditions

of Irish existence as to work a gradual change in the national character, is a question of much interest, but too large to be discussed just now. In any case we can scarcely expect the results of centuries upon a national type to be reversed in less than a succession of generations.

Still confining myself to the past, let me point again to the very marked qualities which the conditions of their existence have produced in the people of the United States. They started with a large element of English energy already ingrained into them; they have been reinforced by millions of emigrants presumably of more than the average energy of the various races which have contributed to swell the tide. Added to this, the Americans have enjoyed the natural stimulus of a practically unlimited field for colonisation. Only the resolute, self-reliant settler could hope to prosper in the early days of their national existence; and self-reliance approaching to audacity is the special type of character which on the Darwinian hypothesis we should expect to see developed, transmitted, and increased. How far this accords with actual experience, no one can be at a loss to say. There is probably not a nation in the world whose peculiarities might not be traced with equal ease to the operation of the same universal principle. And the moral of the investigation is this: Whenever a law is sufficiently ascertained to supply a full explanation of all past phenomena falling within its scope, it may be safely used to forecast the future; and if so, then to guide our present action with a view to the interest and well-being of our immediate and remote descendants. Read by the light of Darwinism, our past history ought to solve a multitude of perplexing questions as to the probable supremacy of this or that nation in times to come in the field of commerce, as to the effects of emigration and immigration on the ultimate type likely to be developed in the country that loses and in that which gains the new element of national life, and many another problem of no less interest to ourselves and to humanity.

The subject I have thus slightly indicated seems to me to deserve a closer investigation than it has yet received: and, strange as it will sound to the ears of politicians, I cannot doubt that, in this and other ways, statesmen, if they could open their eyes, might derive abundant aid from the investigations of science, which they almost uniformly neglect and despise. H.

THE PROGRESS OF NATURAL PHILOSOPHY

[We have been favoured by Professor Tait with the following extracts from his Introductory Lecture to his class at Edinburgh University, the object of the Lecture being "to show that Natural Philosophy is a *real* science, as tested by steady growth and progression, compared with other so-called Philosophies, which have periodic cycles, and come back after a generation or two into the old, old groove, with the same old rope of sand to be spun over again."—ED.]

TO enumerate in detail all the advances effected in natural philosophy during even the past year would take more time than is usually devoted to a lecture, so that I shall confine myself to a mere mention, not exposition, of a very few of the more interesting discoveries in cosmical science which have recently been made.

First. We have obtained an immense amount of new information as to the constitution of the sun. The total eclipse which was visible in India in the autumn of last year, was singularly well fitted for applying to the strange phenomena of the sun's atmosphere the comparatively novel powers of the spectroscope. Another total eclipse has recently been carefully observed in America, and the results obtained on these two occasions agree well with one another.

One of the most marked phenomena observed in a total solar eclipse is that which, first carefully described some thirty years ago, was called the "red flames;" very singular protuberances issuing apparently from the dark body of the moon, but which were conclusively proved in 1860 to belong to the sun. Had they been lunar phenomena, their dimensions would have been considerable; but it is easily shown that, belonging to the solar atmosphere, their dimensions are *enormous*, a hundred thousand miles being often no exaggerated estimate of their diameter. They must evidently be masses of extraordinary tenuity, else they could not rest in the solar atmosphere, which must be excessively rare at such an elevation. When the spectroscope was directed to them last year, it was at once perceived that they are fiery clouds, consisting mainly of hydrogen gas, heated so powerfully as to become self-luminous. This discovery once made, the total eclipse was seen to be unnecessary, and observations of these singular phenomena are now carried on every day. In fact, in anticipation that such would prove to be their nature, they had actually been sought for before the date of the eclipse. The reason why we can see them, in spite of the comparatively overwhelming light of the sun, is simply this, that the sun's light, which may be said roughly to consist of rays of all degrees of refrangibility, can by a sufficient number of prisms be spread over any desired extent, and thus weakened throughout; while the light from the red flames consists of but a few perfectly homogeneous rays, which may be indefinitely separated from one another, but cannot be individually weakened, by increasing the power of the spectroscope. The process, in fact, closely resembles that by which, with powerful telescopes, astronomers are enabled to observe stars in the day-time. The powerful telescope diminishes the apparent brightness of the sky; but the star has no sensible diameter, and remains undimmed. A singular fact observed is, that while the bright rays in these red flames, which are due to hydrogen, correspond exactly to well-known dark lines in the solar spectrum, due to absorption by the sun's atmosphere; there are others, especially a curious one in the yellow, which have no counterpart among the dark lines. Also the hydrogen lines are sometimes broader, sometimes narrower, than the normal spectrum of incandescent hydrogen requires; sometimes they are slightly displaced from their normal positions in the spectrum. The explanation (on purely physical grounds) of all these phenomena is now being carefully sought, and the connection of the red flames with sun-spots, as well as the singular peculiarities of the spectra of spots, are being recorded for future explanation. In this one direction alone a field has been opened up for inquiries which, even with our present appliances for observation, may well occupy the world for a generation to come.

Another striking phenomenon of a total solar eclipse is the (so-called) Corona of whitish light which appears to surround the dark body of the moon to a considerable angular distance. This also has been proved to belong

to the sun. Part of its light is, no doubt, merely sunlight reflected from the matter of the sun's atmosphere, or from cosmical bodies revolving about the sun; for it has long been known to be partially polarised. But it is only within the last few months that *its* spectrum also has been observed, and found to consist mainly of bright lines—*i.e.* of a few rays of definite refrangibility. The positions of the most marked of these have been measured, and they are found to correspond with those of the light of terrestrial auroras! This is one of the most startling results yet obtained by observation; for the aurora is intimately connected with, or at all events has an important effect on, terrestrial magnetism, and it has been known for some time that disturbances in the sun have a marked effect on the magnetism of the earth.

Our sun is a variable star. It has been proved that its spots have an eleven-year period of maximum frequency. Laborious calculations are now in progress at Kew Observatory, with the view of tracing the cause of this periodic effect; and it seems already to be traced with some certainty to the planets, principally to Mercury, Venus, and Jupiter; the first, though very small, being very near, and the last, though very distant, being very large. Now, the red flames, or hydrogen clouds, are intimately associated with sun-spots. Hence we connect *their* frequency with the variability of sunlight. Now, it is only a year or two since an exceedingly well-marked case of a temporary star was visible in the northern hemisphere; a star, usually of inconsiderable magnitude, scarcely visible to the naked eye, suddenly blazed out with brightness rivalling that of Sirius. The spectroscope showed that it owed this increase of its light almost solely to incandescent hydrogen, the chief material of the flame-cloud that hovers over a *solar* spot.

Nor is it only in solar and stellar phenomena that these extraordinary recent advances have been made. Bodies even more puzzling and anomalous than the sun and stars are common enough in the universe. Many nebulæ, long imagined to be immense groups of stars, at such enormous distances that the several constituents were indistinguishable by the most powerful telescopes, have been shown to shine as glowing gas merely, rendering it probable that we have to deal with objects which, though certainly at vast distances from the earth, are probably not vastly farther away than some of the nearest stars. Possibly, in some cases, they may be much nearer, in which case they may be suns which have cooled, and are still surrounded by glowing gas, due to the impacts of small cosmical masses, or meteorites, on or near their surface. Or they may be vast systems of small cosmical masses in the act of grouping themselves by mutual gravitation, impact, and friction into a new star, the incandescent gas being due to the impacts and the friction. In them we may be actually watching the formation of a solar system.

Finally, let us consider what we have recently learned about comets—bodies which have hitherto puzzled the astronomer quite as much as have the nebulæ. Several ingenious speculations have recently been published on this very interesting subject, but I shall only mention one with any detail. There seem to be good grounds for imagining that a comet is a mere shower of stones (meteorites and fragments of iron). This at least is certain, that such a shower would behave, in its revolution about the sun, very much as comets are seen to do, and that, as we have reason to believe is the case with comets, it would be drawn out after a few revolutions, if it described a closed path, so as to be spread over the greater part of its orbit. If the earth, then, were at any time to intersect the orbit of the comet, it would pass through a stream of such stones, all moving approximately in parallel lines and with equal velocities. On entering the earth's atmosphere with the enormous relative velocity due to revolution about the sun in differently sized orbits, described sometimes with a retrograde motion, these fragments of stone would, by the laws of perspective, describe paths all apparently diverging from one point in the heavens, and these paths would be rendered visible by the incandescence of the meteorites due to friction of the air. Now this is exactly what we see, markedly in August and November every year, less definitely at other fixed periods. And the orbits of the August and November meteorites have been determined, and found to be identical with those of two known comets. I cannot enter very fully into this most interesting subject now, but I may say a few words more in explanation. Unfortunately, since spectroscopes have been in everybody's hand, no notable comets have appeared. [How strange it *now* seems to us that the magnificent comets of 1858 and 1860 were allowed to pass without having been looked at through a prism by anyone, whether as a matter of chance or of curiosity!] Such small comets as have been observed have given *continuous* spectra from their tails, so far as could be judged with regard to an object so feebly illuminated. This, then, it would appear, is simply reflected solar light. The heads, however, give spectra somewhat resembling those of the nebulæ I have just mentioned—the spectra of incandescent gases. This is quite consistent with the descriptions given by Hevelius and others of some of the grander comets; which presented no peculiarities of colour in the tail, but where the head was blueish or greenish. Now these appearances are easily reconciled with the shower-of-stones hypothesis. For the nucleus, or head, of a comet is that portion of the shower where the stones are most numerous, where their relative velocities are greatest, and where, therefore, mutual impacts, giving off incandescent gases, are the most frequent and the most violent. This simple hypothesis explains easily many very striking facts about comets, such as their sometimes appearing to send off *in a few hours* a tail many hundreds of millions of miles in length. Wild notions of repulsive forces vastly more powerful than the sun's gravity have been entertained; bold speculations as to decomposition (by solar light) of gaseous matter left behind it in space by the comet have also been propounded; but it would seem that the shower-of-stones hypothesis accounts very simply for such an appearance. For, just as a distant flock of seabirds comes suddenly into view as a dark line when the eye is brought by their evolutions into the plane in which they fly, so the scattered masses which have lost velocity by impact, while they formed part of the head, or those which have been quickened by the same action, as well as those which lag behind the others in virtue of the somewhat larger orbits which they describe, show themselves by reflected solar light as a long bright streak whenever the earth moves into any tangent plane to the surface in which they are for the time mainly gathered.

It is a most valuable principle in physical science, never to be lost sight of, that we must not seek to explain by the assumption of new species of force or action any phenomena which have not been recognised to be inexplicable by means of properties of matter or motion already proved to exist. Before leaving this subject I must refer to the extraordinary fact, lately ascertained, that the spectrum of the head of one of the smaller comets is that of incandescent vapour of *carbon*, of a substance which, with the most tremendous heat attainable in our laboratories, we cannot even melt, much less reduce to vapour: so that to find its spectrum we are obliged to employ it as it exists in olefiant gas or other combined form. But it is premature to speculate further on such incomplete data as we yet possess with respect to the spectroscopic appearances of comets. It is not rash to venture the prediction that the very first application of the spectroscope to a really fine comet will give us at least as much additional insight into the nature of these bodies as the total eclipse of 1868 gave with regard to the atmosphere of the sun. P. G. TAIT

DANA'S MINERALOGY

A System of Mineralogy: Descriptive Mineralogy comprising the most Recent Discoveries. By James Dwight Dana, Silliman Professor of Geology and Mineralogy in Yale College, etc., aided by George Jarvis Brush, Professor of Mineralogy and Metallurgy in the Sheffield Scientific School of Yale College. Fifth edition, 8vo. pp. 827, figures 617. (London: (Trübner & Co.)

II.

EXCEPT in the subdivisions of the silicates, Professor Dana has adhered pretty nearly to the classification adopted in his fourth edition; which accords also in its general features, though not in its details, with that on which the minerals in the British Museum are arranged. The arrangement of the silicates in his new edition is a step that must be called tentative towards a simpler and more philosophical classification of these numerous and important salts. We certainly feel some hesitation in adopting either the terminology or the divisions Professor Dana introduces. The terms bi- and uni-silicate are not happy for the expression of oxygen ratios; not so happy, for instance, as the term singulo-silicate used for the latter by Rammelsberg, or the ortho-silicates of Odling. We own to a partiality for the view of Dr. Odling regarding the different classes of silicates, on the ground partly of the harmonious relations he introduces between these and other multibasic salts, and also from the satisfactory way in which these very important minerals group themselves as ortho-, para-, or meta-silicates. We may take another occasion for illustrating this, and pass on to Professor Dana's new and scholarlike handling of the whole question of nomenclature.

Our author has shirked no labour or odium in the way he has faced this question. That trivial names are absolutely necessary in mineralogy no one who has dealt with the subject at all philosophically will question. Even such semi-trivial terms as ferrous aluminic garnet, calcio-ferric or magnesio-aluminic garnet, are almost too long for use; but how should the composition of these bodies be described by names purely chemical?

Generally, therefore, we feel bound to acquiesce in the use of a trivial name for each mineral, and to subscribe to the rules Professor Dana has laid down for such names. These may be stated as the use of the termination *-ite*, except in names that have a hold on literature or use; some care in adhering to proper etymological principles in derivative names; and, finally, the law of priority of claim accorded in general, but with proper exceptions, to the first describer of a mineral. In applying these rules, Dana retains, so far as wec an enumerate them, some thirty-four names not ending in *-ite*, and changes about forty-seven of the names more or less generally received.

We cannot, however, concur in the Professor's criticism in his derivation of the spellings in all cases from the pseudo-Latin names given to metals by the chemist. Thus, to call nickeline "niccolite" and not "nickelite" is to lose sight of an essential part of the original form of a word of which, in fact, our familiar term "Old Nick" is the English shape. Surely, too, bismuth ochre should become not bismite, but bismuthite. Nor can we agree with the dismissal by Dana of the term hemimorphite, which was given to the monohydrated dizincous silicate by Kenngott. Our author reverts to the old name of calamine, between the use of which and of smithsonite, as names sometimes attached to the zinc carbonate, sometimes to the silicate, there has long existed a confusion that is best ended by the adoption of at least one new name. And Kenngott's term had at any rate this great merit, that it seized a characteristic of the crystallised silicate, by virtue of which it stands conspicuous among almost all other minerals, and certainly is distinguished from the other calamine, the character, namely, of being truly hemimorphous; that is to say, of presenting a given crystalline form all the planes that should occur on one side of a plane of symmetry, and none of the planes of that form that would, if the crystal were holosymmetrical, be met with on the other side of that plane of symmetry. We plead, therefore, strongly in behalf of Kenngott's name. As regards the merging of the term hornblende in that of amphibole as carried out by Dana, we would prefer to see the whole nomenclature of these augitic and hornblendic minerals so handled that we might have a general term for all the groups of minerals united under a common chemical type; and separate terms, still generic, that might embrace the minerals, whether of prismatic, oblique, or anorthic type, that present the kind of homœomorphism that demarks these groups. The trivial names for the different species or varieties under each group would remain nearly as they are. Now Professor Dana selects the term amphibole for the most general of these expressions, and he includes under a pyroxene sub-group enstatite (prismatic), wollastonite (oblique), and what he further calls pyroxene (oblique but homœomorphous with enstatite); and then after a spodumene sub-group he introduces an amphibole sub-group. We venture to think that the term "amphibolic minerals" used for the whole might well be made to embrace: Firstly, an augitic group, including as its members, (*a*) enstatite, with hypersthenic minerals, (*b*) diopside, with sahlite, hedenbergite, and the fassaite (aluminous varieties, (*c*) spodumene and petalite, (*d*) achmite, (*e*) rhodonite and babingtonite; Secondly, a hornblendic group, embracing as its subdivisions, (*a*) kupfferite with anthophyllite, (*b*) tremolite, with actinolite, grünerite

and the pargasite (aluminous) varieties, (*c*) arfvedsonite; Thirdly, wollastonite.

Of course only a few leading varieties are here noticed. As regards other names introduced by Professor Dana, we are fain to accept even so uncomfortable a name as prochlorite in place of chlorite, a term to the chemist's ears so ambiguous in its sound. To most of Professor Dana's other changes, also, we with more or less of readiness subscribe; though against the barbarous conversion, not newly introduced into this edition of Dana, of one of the most ancient terms in mineralogy, pyrites, into pyrite, in flagrant defiance of all etymological principle, we must continually protest.

We have noticed the more important novel features in this fifth edition. There is still much to be said regarding the degree of fulness with which different parts of the descriptions of the minerals are given, such as the pyrognostic characters, and the treatment of the chemical analyses. But when we consider the vast amount of matter collected into some 800 closely-printed pages, the scrupulous care with which so enormous a number of references has been made to the labours of mineralogists, extending over the whole area of the scientific literary works of a century past—ay, and often into the two or three centuries before that; when we remember that the progress of the science up to 1868 is thus fully, concientiously, and elaborately recorded, we can only thank Professor Dana, in the name of European mineralogists, for the very valuable volume by which he has so much lightened their labours: and with his name we must associate that of the accomplished mineralogist who has shared his labours, Prof. Brush. If in fulness their joint work does not come up to the now, alas! almost obsolete work of Hausmann, it is three times more portable. W. H. Miller's invaluable book, modestly called by him an edition of Phillips, is again a mineralogical crystallography. The only book that at present professes to cover the ground occupied by Professor Dana's work is the admirable *Manuel* of Des Cloizeaux, of which, however, only one volume has yet appeared, but which unites to the sort of originality in crystallographic and physical research which gives Miller's work its value, something of the universality of treatment which Dana gives to his mineral species. We wish, indeed, that M. Des Cloizeaux could have given up the microscopic fractions that characterise the French system of crystallographic notation, and torment the crystallographer's hardly-used eyes, for the more elegant notation of Miller, as he has in fact adopted the stereographic projection. But we look keenly forward to the publication of the second volume at the hands of the new member of the Institute; and, while we do so, we feel confident that as in matter it will be as masterly as the first, and as indispensable to the scientific mineralogist, so it will satisfy scientific needs that differ in kind from those felt by a large proportion of the practical men in whose hands Professor Dana's book will still be a standard treatise.

We have said enough to point out the extreme value of Professor Dana's book, which, taken as an indication of the present state of science in America, is of the best possible augury; and we may add that mineralogy is not the only science represented in high-class American text-books. Chauvenet's "Astronomy" is another instance which at once suggests itself.

N. STORY MASKELYNE

BIBLIOTHÈQUE DES MERVEILLES

L'Acoustique, ou les Phénomènes du Son. Par R. Radau. Ouvrage illustré de 114 vignettes.—*L'Optique.* Par F. Marion. Ouvrage illustré de 70 vignettes sur bois, et d'une planche tirée en couleur.—*L'Electricité.* Par J. Baille. 71 vignettes.—*Les Forces Physiques.* Par Achille Cazin. 58 vignettes. (Hachette; Paris and London.)

Thunder and Lightning. By W. de Fonvielle. Translated from the French and edited by T. L. Phipson, Ph.D., F.C.S.—*The Phenomena and Laws of Heat.* By Achille Cazin. Translated and edited by Elihu Rich. (London: Sampson Low, Son, & Marston.)

THESE works form part of a series having the general title, "Bibliothèque des Merveilles," which will be extended to about a hundred volumes, and will form a Cyclopædia of the more prominent wonders of the universe—of all that is "most admirable in Nature, in the sciences, in industry, in history, in man." It is published under the direction of M. Edouard Charton, and the main object to be attained by it is "seconder l'heureux mouvement qui porte aujourd'hui toutes les classes de la société vers l'instruction." The majority of the volumes which have already appeared relate to applied science, and here we may remark that MM. Hachette have done much to disseminate a taste for science among all classes by the publication of works suited to the most varied capabilities and the most varied means. Commencing at one end of his series, we have twenty and thirty franc "editions de luxe" of the *Le Ciel* and *Phénomènes de la Physique* class; and, passing through various gradations, we arrive at length at the two-franc volumes of the "Bibliothèque des Merveilles." The last volumes have much to recommend them; they are, for the most part, popular in style; they are well illustrated, well printed, and undeniably cheap, and they are written by men, among whom are many who are engaged in giving instruction in one or other of the multifarious educational establishments of France. We have no series of books in this country to compare for excellence and cheapness with these, and this mainly arises from the fact that science does not form an essential part of our educational system, as it does of that of France. The volumes of the "Bibliothèque des Merveilles" can be sold in France at less than one-half the price which would be demanded in this country, because the publisher can feel certain when he issues his work that a large number will find their way into the various schools and colleges of the Empire.

M. Radau's "Acoustics" is quite a type of a French popular scientific work; with every desire to convey as much information as possible, the author will not give up a certain amount of light amusing matter, and a popular style. How surprised we should be in this country to see a woodcut of a dancing bacchante (somewhat like Salvioni) in a chapter entitled "Le Timbre," and not far from a representation of the "Progression d'une vibration longitudinale." A vague unscientific reader might be led to find an analogy between Cagniard de la Tour's syren and Radau's bacchante; the bacchante occupies a full page, while the syren has a little strip of space in the text, and we ultimately discover that the former has been introduced solely for the purpose of showing the *crotalon*. Among the many good features of this book,

we may mention that it enters somewhat fully into the growth of music, and traces the connection between the science of sound and the art of music. From this we learn that the names of the first six notes were introduced by Guido of Arezzo, in 1026, and that they were the commencement of words taken from a hymn which is still sung on S. John's Day :—

"*Ut* queant laxis *re*sonare fibris
*Mi*ra gestorum *fa*muli tuorum,
*Sol*ve polluti *la*bii reatum,
Sancte Ioannes."

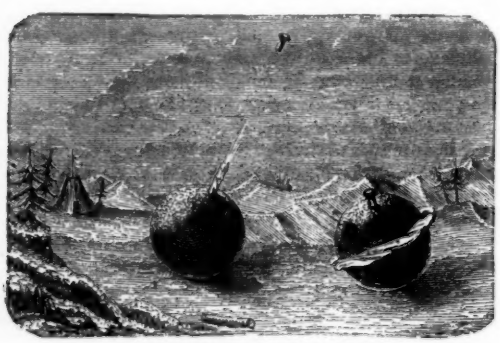
The seventh note was designated *si*, in 1684, by Lemaire, and was taken from the initials of Sancte Ioannes. We may mention the chapters on the reflection of sound, on interference, and on the voice, as being of special interest. In the first of these the famous echo of Athanasius Kircher is described; the echoes in this case are produced by walls placed at certain distances apart, and at right angles to another wall; the observer cries :—

"Tibi vero gratias agam, quo clamore?"

and the echo answers :—

"Clamore—Amore—More—Ore—Re.

The work on "Electricity," by M. Baille, is of a less popular character than the above; it treats solely of the applications of electricity, and is divided into four parts: Electric Telegraphy, Induction Machines, the Electric Light, and Galvanoplastic Art. M. Cazin has previously published a work on Heat in this series, and his "Forces Physiques" is of the same character; they are essentially sound, accurate in detail, and are well adapted for those who are commencing the study of physics. Many of these works have been translated into English, and we are glad to know that the greater number of the books of the "Bibliothèque des Merveilles" which have not yet appeared are now in course of translation, among them



EXPANSIVE FORCE OF FREEZING WATER

L'Acoustique, which ought to be used in all schools in which music is taught, and therefore notably in Ladies' Schools. M. Marion's *L'Optique* has been translated by Mr. C. W. Quin, who has introduced a chapter on the spectroscope, unfortunately without an illustration. The work is concluded by a full account of the ghost illusion of which we heard so much a few years ago. M. de Fonvielle's "Thunder and Lightning" retrogrades somewhat from the works noticed above, in that it is of a more sensational character. Thus we have full-page woodcuts of "a murderer struck by lightning;" of a broad stream of lightning meeting a lady as she comes upstairs; of an explosion of gas by lightning, and so on. The best woodcuts in the book are those which represent the photographic reproduction of an electric spark. M. Cazin's work on

PHOTOGRAPHIC IMAGE OF ELECTRIC SPARK

"Heat" is strictly scientific in character, and might with advantage be used as an elementary text-book in schools.

We hope before long to find this series of books altogether naturalised in this country, and no time could be more fitting, since science has at length been recognised as a useful educational engine.

G. FARRER RODWELL

OUR BOOK SHELF

Chemical Exercises. — *Arithmetical Exercises for Chemical Students.* By C. J. Woodward, B. Sc. (London: Simpkin, Marshall, and Co., 1869).

MR. WOODWARD, who is lecturer on chemistry and physics at the Midland Institute, Birmingham, has printed, under the above title, a set of ten very useful cards, to assist students in familiarising themselves with the more common numerical calculations of chemistry. Each card contains, first the *data*, and secondly the *method* of a particular kind of calculation; this is followed by a number of questions. Ten subjects are gone over in this way. I may describe them as: (1) the metric system; (2) conversion of thermometric readings, and reduction of gaseous volumes: (3) specific gravity; (4) formulæ as yielding percentage composition; (5) percentage composition a source of formulæ; (6) weight and chemical effect; (7) volume and chemical effect; (8) reactions of gases; (9) the crith and thermal units; (10) specific, atomic, and latent heat. This range is amply sufficient for all ordinary purposes.

Although there are great conveniences in the use of a card system of instruction, especially when clearness in the printing is as well attended to as in these specimens, an objection lies against it that, in this case particularly, a good deal of repetition is unavoidable. In Mr. Woodward's *data*, the same symbolic values are tabulated over and over again. Could not these have been collected in

a single group, once for all? Much space might also have been gained for questions by giving what corresponds to a title-page only on the first card. Thoroughly systematic names, based on a *single* principle now in use, ought alone to be employed in elementary teaching. "Argentic chloride," "silver chloride," "corrosive sublimate," are names of three quite distinct kinds which, we have found, the author employs without comment. A nomenclature card would indeed be a valuable prefix to the series. It would also be an advantage to append answers to all the questions.

Clearly expressed rules, and good examples of the mode of applying them, are so obviously useful to students, that it only remains to add that Mr. Woodward has done his work well. E. J. M.

Agricultural Engineering.—*Der Cultur-Ingenieur.* Herausgegeben von Dr. F. W. Dünkelberg. (Brunswick, 1869.)

THIS periodical, a quarterly journal in its second year of publication, professes to deal with all questions of applied science affecting agriculture. The papers contained in the present number are mostly of a thoroughly practical character. They treat of such matters as the testing of steam-engines at agricultural exhibitions, the examination and adjustment of levelling instruments, the cause of boiler explosions, the mean velocity of water in canals and rivers, and the usefulness and profitableness of various machines for agricultural purposes. One paper gives a description of English locomotives for use on ordinary roads. The journal is well got up and amply illustrated.

The Microscope and its Use. By Dr. H. Hager. (*Das Mikroskop und seine Anwendung.* (Berlin: Springer.)

THIS little work gives, in less than a hundred pages, first, a brief account of the microscope and of microscopic appliances; secondly, a still more rapid description of common microscopic objects. It is, in fact, very much like our own "Carpenter on the Microscope," on a very reduced scale. The first part is written with great sense, and very much to the purpose. We are not surprised that the little work has received in Germany the unusual honour of a third edition.

Freshwater Radiolaria.—*On some Freshwater Rhizopoda, new or little known.* By William Archer. (*Quarterly Journal of Microscopical Science*, July and October, 1869.)

MR. ARCHER, of Dublin, who is well known as one of the contributors to Pritchard's "Infusoria," and a careful observer, has for the last two or three years chronicled in the Proceedings of the Dublin Microscopical Club, published in the *Quarterly Journal of Microscopical Science*, the occurrence of Radiolarian-like Rhizopods in the moor-pools of Ireland. At the end of last year Dr. Focke, of Bremen, described and figured a few of the same forms, bearing a likeness to some which have been considered as belonging to the genus Actinophrys, or sun-animalcules, of Ehrenberg. Mr. Archer has at length published the description of his new species, with full illustrations in three folding coloured plates. Many of these new fresh-water Radiolarians, like the marine forms which they appear to represent in fresh water, carry siliceous spicules; they are mostly globular, and have a capsule surrounded by protoplasmic matter, which is drawn out into very long and delicate threads or rays, whilst the spicules are aggregated so as to form a loose sort of skeleton. In one large species Mr. Archer found several globular capsules united in one individual (*Raphidiophrys*). The contents of the capsules are coloured green in some instances, in other species they are red, or colourless. These most interesting animals are found only in moor-pools, and are, therefore, not to be got at by every observer. It is, therefore, very curious that besides Mr. Archer's and Dr. Focke's publications in this year, Dr. Richard Greef, of Bonn, should also have turned his attention to them, without being aware of Mr. Archer's work. In No. 3 of Max Schultze's *Archiv* for this year, Dr. Greef has a paper and plates, describing some species and genera *identical* with those of Mr. Archer, who, however, has precedence by some months. The fresh-water Radiolaria, it has been suggested, stand in the same relation to the more exuberant and highly developed marine Radiolaria, as do the fresh-water Hydrozoa represented by Hydra to the much more numerous, more brilliant, and varied marine Hydrozoa.

E. R. L.

The Annals and Magazine of Natural History.—No. 24. December, 1869. (Taylor and Francis.)

THE last number of this journal contains several valuable papers, of which the most important is undoubtedly Mr. Carter's description of the Development of *Sorastrum spinulosum*, which will be read with interest by botanists. Dr. Leconte, of Philadelphia, contributes a list of beetles collected in Vancouver's Island by Messrs. H. and J. Matthews, with descriptions of a considerable number of new species. Dr. Leconte does not cite any of the species from the same locality described by Mr. Francis Walker in Lord's "Naturalist in Vancouver's Island and British Columbia;" in all probability he will find that some of his supposed new species are already described.—Mr. T. Vernon Wollaston publishes a continuation of his paper on the Coleoptera of St. Helena, the general results of which we propose to give on its completion.—A third entomological paper is by Mr. Fred. Smith, on the Parasitism of *Rhipiphorus paradoxus*, in answer to a communication in the November number by Mr. Andrew Murray, in which that gentleman maintained that the larva of *Rhipiphorus*, which is always found in the cells of wasps, is a parasite rather in the classical than in the natural history sense of the term; that is to say, that it merely lives upon the food furnished to the wasp-larva, and does not feed upon the substance of the latter. In opposition to this view, Mr. Smith cites observations made by himself and by the late Mr. F. Stone, which show clearly enough that the larva of *Rhipiphorus* is not hatched until the wasp-larva is approaching maturity, that it speedily fastens upon its companions, and appropriates the latter's materials with so much avidity as to attain its full growth in about forty-eight hours.—Other purely zoological papers are—A description of a new British spider belonging to the genus *Epeira*, by Mr. John Blackwall; descriptions of two new species of sun birds from the Island of Hainan, by Mr. Robert Swinhoe; and a notice of some nondescript bones in the skull of osseous fishes, by Mr. George Gulliver. The bones referred to in the last-mentioned paper are to be found in the head of the codfish at the hind part of each post-frontal bone. There is one on each side of the head, and their form is that of a sub-conical cup. The author calls them *exposttfrontal ossicles*. Similar limpet-shaped ossicles hitherto unnoticed occur in other parts of the head.—In a joint paper on the Nomenclature of the Foraminifera (the thirteenth of a long-continued series), Messrs. Jones, Parker, and Kirkby describe the extraordinarily varied forms under which a species, to which they attribute the name of *Trochammina pusilla*, presents itself. These forms, which have of course received a great number of different names, are represented by the authors on a plate; they occur fossil in almost all formations from the Permian to the Tertiaries, and some of them are living in our present seas.—In a short contribution to Jurassic Palæontology, Mr. Ralph Tate indicates the necessity for breaking up the great genus *Cerithium*, and notices that the genus *Kilvertia*, established in 1863 by Lycett, at the expense of *Cerithium*, is identical with *Exelissa*, Piette (1861), of which he describes a new British Liassic species. He also proposes the formation of a new genus, *Cryptaulax*, for another group of *Cerithia*, in which the aperture more resembles that of *Chemnitzia*, and the posterior canal is concealed by the outer lip.

THE JAPANESE

JAPAN is a country of which the outer barbarian world as yet knows little. By slow degrees, however, the great wave of progress is making inroads even in that jealously guarded group of islands; but as yet it is but in three places, not in themselves of much importance, that the country is open to foreign commerce. The capital is only accessible to diplomatic agents, and the excursions which have been made into the interior have been of an imperfect kind.

Yeddo, with the great volcanic cone of Fusiyama prominent in all the views of the city; Yokohama, Kanagawa, Kagosima, the Central Sea,—these names bring before us almost all that we really know about Japan. There are maps of the empire to be found, which show the divisions and towns of the great island of Nippon, and also of the smaller islands of the group; but we know little of them, except their names and their relative position. The day is yet to come when the physical geography of this fine group of islands will be laid bare to the researches of Western men of science. The latitude of the islands, together with the influence of that warm ocean current which may be called the Pacific Gulf Stream, ensures for them a mild climate; and rice, cotton, and silk are among the varied productions of this favoured country. At the same time, it must not be forgotten that earthquakes are not unusual, that the volcanic fires are not yet extinct in Japan, and that the shores are sometimes visited by the fierce typhoons which desolate the neighbouring seas.

The people themselves, however, their religion and government, their houses, their manners and customs, have been subject to observation in the different towns open to foreigners; and several accounts have been laid before the public. Of these, none is more interesting than the narrative of his life in Japan which has been given to the world by M. Aimé Humbert,* the Swiss minister in Japan, who arrived there in the year 1863, and who has prepared a narrative of his sojourn in Yokohama and Yeddo, and his excursions in the neighbourhood of these places, which is extremely lively and interesting. M. Humbert's observations are chiefly upon the people; and his remarks, and the number of illustrations with which the descriptions in his two magnificent volumes are enriched, bring before us the Japanese, at least of the cities, with very great vividness. They live and move before our eyes: we see them in their temples, in their court dresses, in their everyday life, in their amusements, in the pursuit of their trades and professions, in the exercise of justice, in the celebration of their annual fêtes.

The Japanese, M. Humbert thinks, are of diverse origin. Some possibly came from China, some were Mongols from the neighbouring Corea; but doubtless many derive their descent from ancestors whose frail boats were drifted from the Malaysian Archipelago far to the south. The Japanese are not a tall race; the head and chest are generally large, the legs short, the hands small and often beautiful, the hair long, smooth, and black, the nose well-defined, the eyes more prominent than those of Europeans, the dominant colour of the skin an olive brown, though the colour varies from an almost copper brown to a dull white. The women are lighter in colour than the men, and in the higher classes they are often perfectly white.

In their domestic relations the Japanese are kindly, especially to their children, for whom they have intense affection, and for whose pleasure they will make any sacrifice. The Japanese takes but one wife; but he has it in his power to take secondary spouses, and not unfrequently avails himself of the privilege. The Japanese women are in a state of extreme subjection to their lords.

The religion of the vast mass of the people is Buddhism, with a vast array of bonzes or priests, and great temples, colossal idols, and a complicated system of worship. One of the grandest of the idols is well described by M. Humbert; it is the image of Diaboudhs, the great Buddha:—"The road to the temple is distant from all habitations; it winds between tall hedges, then a straight road mounts up between foliage and flowers, then a sudden turn follows, and all at once, at the end of an avenue, is seen a gigantic divinity of copper, seated in a squatting attitude, with the hands joined and in the attitude of contemplative ecstasy." The acceptance of the Buddhist doctrine of the ultimate passing of man into annihilation produces, it is said, in the Japanese, that wonderful disregard of human life which is one of their most remarkable characteristics. But besides the Buddhist theology, there is also a worship of the Kamis, or ancestral divinities, which prevails in Japan. The Kamis are not always the ancestors of separate families; the greatest of them, indeed, are the fabled ancestors of the whole Japanese race. But the belief in these ancestral deities leads to a vast amount of reverence being paid to the memory of the dead, and to annual visits to the tombs of the departed. These visits to the hills of the dead which surround the towns

HOTEÏ

are distinguished by much illumination of torches, and terminate with a setting afloat of little boats, each with lights, which drift down the river at night, and of which the lights are one by one extinguished. There is, besides, a belief in a number of tutelary deities, some of whom are half-mystic heroes—gods who preside over the events of life, whose *fêtes* are occasions of much national rejoicing, and whose influence contributes to counteract the sombre effects which an exclusively Buddhist belief would produce. Of one of these, Hoteï, the accompanying illustration gives a representation, the fac-simile of a Japanese drawing. Hoteï is the personification of contentment in the midst of poverty. He is the sage who possesses no worldly goods—the Diogenes of the great Nippon. His sole belongings are a scrap of coarse hempen cloth, a wallet, and a fan. When his wallet is empty he only laughs at it, and lends it to the children in the street, who use it for their games. For his part, he converts it by turns into a mattrass, a pillow, a mosquito-net: he seats himself on it as on an inflated skin to cross a current of water. Hoteï leads a somewhat vagabond life. He is sometimes met mounted on the buffalo belonging to a cultivator

* Le Japon illustré, par Aimé Humbert, ancien plénipotentiaire de la Confédération suisse. 2 vols. 4to. L. Hachette et Cie, Paris.

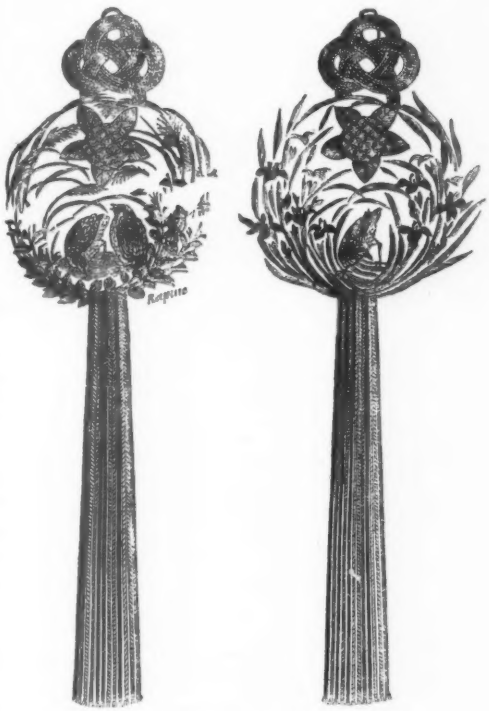
of the rice-fields. All the country-folk are his friends. He sleeps under the trees; and the children awake him. Then he takes them in his arms, tells them stories of the sky, the moon, the stars, all the magnificence of nature, treasures which no one knows better than himself how to enjoy.

The government of Japan is a species of feudal confederation, with a theocratic head. The Mikado, the son of the gods, and hereditary emperor, is the representative of the sacred power; but the civil and military administration rested until very recently in the hands of his lieutenant-general, the Tycoon, whose headquarters were in Yeddo. The great princes, or Daimios, are in many instances almost independent, and they are only held in subjection by being obliged to have a double residence; one on their own estates, and the other in Yeddo, where their families are kept as hostages for their good behaviour. The Yaconins, or military following of the Daimios, constitute a turbulent class of the population, bound solely to their feudal lords, and ready for any fray that may happen. It is among the Japanese of the upper classes that the act of *kara-kiri* is practised. This is a suicide, nominally accomplished by plunging a knife into the bowels, but really, in cases of punishment, by the assistance of the person who stands prepared to strike off the head of the victim at the moment when the knife is placed for the fatal blow.

The Japanese are a cultivated people, with letters and literature partly of Chinese origin, but modified in order to adapt them to Japanese use. They have also a distinct national history; and their literature, though not rich in philosophical disquisitions, abounds in legends, in fables, in satirical descriptions. The Japanese have also highly developed artistic tastes; and painting, drawing, and sculpture are followed as distinct professions. The Japanese drawing does not always satisfy European exigencies with regard to perspective; but the colouring is brilliant, and in Japanese sketches, whether of plants or animals, people or landscape, there is a breadth, life, and truth, which many European artists of much higher pretensions might envy. In fact, the best notions that we can obtain of Japanese life and its surroundings are to be derived from the numerous sketches by Japanese artists which exist, and which represent the people pursuing their daily occupations. M. Humbert has profusely illustrated his work with pictures—partly facsimiles of native work, partly drawn after sketches made by Japanese artists. The Japanese have what the Chinese seem to be deficient in, a strong sense of humour; and this they exhibit in a very striking manner in their sketches, in which human beings are represented by typical animals. Thus, sketches may be seen in which an old bonze is represented as a wolf, a group of Buddhist nuns as weasels, and a company of rats acting as rice-merchants.

The artistic tastes of the people and their love of Nature are both illustrated by their passion for flowers, and by the skill with which they are cultivated. No feast is considered perfect without flowers, and flower-shows meet with as much approbation in Japan as in England. The Japanese gardeners exhibit great skill in the arts of raising new varieties of flowers, of grafting plants, so that different flowers and leaves grow in what appear to be branches of the same plant; and they are, above all, learned in the manufacture of dwarfed plants, which are in great request as house ornaments. The Japanese delight in gardens, and they lay out small pieces of ground with wonderful skill, contriving to "give ample space to narrow bounds" with much ingenuity. The vast *enceinte* of Yeddo encloses much garden ground, and the people make at least three definite excursions to the suburbs at different times of the year, to see with their own eyes how the seasons progress. These excursions are often made as picnics, in which merry family groups take part. The Japanese have also a great fondness for aquaria; every house possesses one, and an aquarium, with small fish in it, is a very common object to be seen in houses.

The Japanese common people, both the *bourgeoisie* and the lower orders, take life with as much enjoyment as possible. The *fêtes* of various gods, who are patrons of one or other of the numerous industries exercised, afford occasion for long processions, with great displays of banners and symbols, for much merriment, and a not always dignified or moderate consumption of saki. Nor are the pilgrimages made to the sacred snow-covered Fusi-yama and to the various habitations of holy hermits altogether without alleviations. The events of domestic life—births, marriages, deaths, presentations of children in the temple, the coming-of-age of boys, when they have completed their fifteenth year, visits to the burial-places of ancestors—all afford occasion for friendly meetings, and for much ceremonial.



SILKEN ORNAMENTS

Theatrical entertainments, and the performances of wrestlers, acrobats, jugglers, and ballet dancers are among the public amusements to which the Japanese are passionately attached. The theatres at Yeddo to which foreigners have had access are chiefly those patronised by the *bourgeoisie;* but among the audience are to be found nobles who assume a dress intended to show that they pay their visit incognito. Wrestlers are under special imperial patronage, and are much favoured by the people. The contests consist chiefly of struggles as to which of two competitors shall by mere weight push the other out of a circle marked off by bags filled with straw. Japanese wrestling is utterly unlike what is understood in England by the same term; and the men engaged in it are generally in a fleshy condition which, among ourselves, would be considered utterly incompatible with a state of "training." The feats of performers who execute wonderful

tricks of balancing, and of jugglers who do the "butterfly trick," which has lately been so popular among ourselves, elicit great applause. So popular also are ballet performances, that even the priests, in some of the great temples, engage in sacred dances to add to the "legitimate" attractions of the places of worship. Fencing is a favourite amusement, and is taught to women.

The public baths where men and women conduct their ablutions in the sight of all the world, and the tea-houses, at which women wait on the guests, are two features of Japanese life which are very strange to European eyes.

The town of Yeddo has a very striking physiognomy, so to speak. To the south are the suburbs on the shores of the bay; in the centre the citadel and the dwellings of the nobility; to the south-east, the trading town; to the east, the quays and bridges of the great river, and on the left bank the industrial city of Hondjo; to the north lie the temples, the fields where fairs are held, the theatres and public places of amusement. The western quarters are occupied by the general city population; and the suburbs of the north and west are full of verdure and flowers.

Yeddo has been calculated to have 1,800,000 inhabitants, although as an important city it only dates from the beginning of the 17th century. It is the northern termination of the great military road, the Tokaido, which traverses the empire from Nagasaki to Yeddo, near to which are built towns, villages, and many houses of the nobility, and along which the Daimois pass when proceeding to their compulsory residence in Yeddo. The modes of travel in use are either horseback, or palanquins carried by men. These latter are of two kinds; the norimon, closed on all sides, and in use among the upper classes, and the cango, light in construction, open at the sides, and used by the common people. As the Daimois pass along with their two-sworded retinue, all passengers give way to them, those that are on horseback dismount, and all stand bending low till the great man has gone on his way. The refusal of foreigners to submit to this fashion has led to the murder of more than one.

Yeddo is a busy town. Cotton and silk manufactures of a delicate kind, the making of porcelain, dyeing, tanning, the working in metals, the carving of stone, wood, and ivory, the manufactures of paper and of leather are all carried on in the town. (An illustration of the delicate silk embroidery which is made by the Japanese is given in the accompanying woodcuts, which represent silken dress ornaments.) In the suburbs, especially of the northern part, the gardens of the florists, the rural tea-houses, and the rice-fields are found. Minor industries—those of the makers of chop-sticks, of toothpowder, of dolls, of makers of mats, basket-work, and boxes, down to that of the humble rag picker—are to be found exercised in the small shops, or in the streets of Yeddo. The streets are full of life. The trades are carried on by the artisans, the jugglers and acrobats exercise their skill, men, women, and children pass along, bent on amusement or pleasure; here an enormous artificial fish, or a flag displayed at a house, announces the birth of a child; there a wedding procession takes its way; a Daimio passes, and all bow to the ground; an alarm of fire from one of the many watchtowers of the city calls out the firemen; the watch goes on its rounds; beggars exercise their arts as a kind of sacred trade—in a word, all the complicated machinery of a busy town life is to be seen in active operation, in what was the great capital of the Tycoon.

A jealous exclusion of foreigners prevailed in Japan for more than two centuries and a half; the only favoured people being the Dutch, who were permitted to build a small factory at Decima, and to send thither annually two trading vessels. The arrival of foreigners and their trade were regarded by the Tycoon and the nobles with dislike, chiefly because of the possibility that the introduction of new ideas might upset the old order of things; and the residence of foreign Ministers in Yeddo was rendered so uncomfortable, and even dangerous, that the legations settled in Yokohama as their permanent place of residence.

Recent events have effected a great change in the government of Japan. The Mikado, the theocratic emperor, has abolished the office of Tycoon. He has left his sacred city, and established himself, temporarily at least, in Yeddo, where the legations are in greater security than before. The export of tea and silk, already great, is increasing: and it is possible that Japan, so long isolated, may in time resume her relations with the outer world, and become, as her early records show her to have been, a busily trading, progressive nation.

It will be seen from the foregoing notice that M. Humbert's volumes contain an immense mass of valuable information as well as exquisite illustrations and lighter matter.

J. A. CHESSAR

FOOD OF OCEANIC ANIMALS

THE receipt of an interesting paper by Professor Dickie, entitled "Notes on range in depth of marine Algæ," lately published by the Botanical Society of Edinburgh, induces me to call the attention of physiologists to the fact, that plant-life appears to be absent in the ocean, with the exception of a comparatively narrow fringe (known as the littoral and laminarian zones), which girds the coasts, and of the "Sargasso" tract in the Gulf of Mexico.

During the recent exploration in H.M.S. *Porcupine* of part of the North Atlantic, I could not detect the slightest trace of any vegetable organism at a greater depth than fifteen fathoms. Animal organisms of all kinds and sizes, living and dead, were everywhere abundant, from the surface to the bottom; and it might at first be supposed that such constituted the only food of the oceanic animals which were observed, some of them being zoophagons, others sarcophagons, none phytophagons. But inasmuch as all animals are said to exhale carbonic acid gas, and on their death the same gas is given out by their decomposition, whence do oceanic animals get that supply of carbon which terrestrial and littoral or shallow-water animals derive, directly or indirectly, from plants? Can any class of marine animals assimilate the carbon contained in the sea, as plants assimilate the carbon contained in the air?

Not being a physiologist, I will not presume to offer an opinion; but the suggestions or questions which I have ventured to submit may perhaps be worth consideration. At all events the usual theory, that all animals ultimately depend for their nourishment on vegetable life, seems not to be applicable to the main ocean, and consequently not to one-half of the earth's surface.

J. GWYN JEFFREYS

GOLD DIGGERS IN THIBET

THE Thibetan gold-field of Thok-Jalung in lat. 32° 24′ 26″ and long. 81° 37′ 38″ was visited by the pundits employed by the G. T. Survey, in 1867 (August). The camp was pitched in a large desolate plain of a reddish brown appearance, the tents stand in pits seven or eight feet deep for protection against the cold wind, the elevation being 16,330 feet, yet the diggers prefer to work in the winter, when nearly 600 tents are to be found there; the soil when frozen does not "cave in." They have no wood, but use dried dung for fuel, and the water is so brackish as to be undrinkable until frozen and remelted. They live well, taking three meals a-day of boiled meat, barley cakes, and tea stewed with butter. They will not use the Himalayan tea, as too heating and only fit for poor folks.

The gold is obtained from an excavation a mile long, twenty-five feet deep, and ten to two hundred paces wide, through which a small stream runs; the implements used are a long-handled kind of spade, and an iron hoe.

The water is dammed up, and a sloping channel left; at the bottom a cloth is spread, kept down by stones so as to make the bottom uneven; one man sprinkles the auriferous earth over the channel, and another flushes the channel by means of a leather bag, the pieces of gold fall into the inequalities and are easily collected in the cloth by lifting up the stones. The yield is large, nuggets of two pounds weight are found; the gold sells on the spot at rather less than thirty rupees per ounce. A gold commissioner or "sarpon" superintends all the goldfields, a string of which extends along the northern watershed of the Brahmaputra, from Lhasa to Rudok. Each field has a chief or master, but anyone may dig who pays the annual licence-fee of one sarapoo or two-fifths of an ounce.

The curious posture for sleeping, universal among the Thibetans, was observed here. They invariably draw their knees close up to their heads, and rest on their knees and elbows, huddling every scrap of clothing they can muster on their backs; the richer rest thus on a mattress rising towards the head. The poorer avail themselves of a suitable slope on the hill side, or pile stones and earth to a convenient height. This position is most probably adopted in order to secure as much warmth as possible for the abdomen, the thighs pressing against it and excluding the air.

The gold-diggers recreate themselves with tobacco smoked in iron pipes, and, notwithstanding the hardships of their laborious toil, seem very merry, singing songs in chorus, in which the women and children join.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents.*]

Lectures to Ladies

YOUR correspondent "M." in her letter, which appeared in NATURE No. IV., on the subject of the exclusion of teachers from the lectures to ladies at South Kensington and University College, is scarcely just in her remark that "at University College they don't pretend to care for such an audience." The committee of the Educational Association certainly do not *pretend* to care for governesses, but give a more substantial proof of their care by admitting them on reduced terms.

All honour to "M." for advocating the claims of governesses; but has she not, in her desire for improving their mental faculties, omitted to take an account of their physical powers? To the question, therefore, which she has propounded—"How can any one who is hard at work all day go to a lecture in the forenoon?"—I am tempted to reply, in the American fashion, by asking another: "How can any one who is *hard* at work all day go to a lecture in the evening?" There is also the minor consideration that the hire of a lecture-room (the majority of our classes being held in a hired room) for the evening is nearly twice that of a room for the morning, so that it would be a somewhat hazardous experiment to institute evening classes on the chance of ladies who are engaged in teaching all day attending in sufficient numbers to pay the rent.

In conclusion, I hope that if "M." can spare a few minutes of her valuable time some forenoon, she will look in at one of our lectures; and if she sees, or rather hears, anyone answering the description of "Lady Barbara, who sneers aloud," I will use my utmost endeavours to get up an evening class for "M." even though she should be the only pupil.

THE HON. SEC. OF THE LADIES' EDUCATIONAL ASSOCIATION, LONDON

Chrysophanus Dispar

YOU ask for information about *Chrysophanus Dispar*. The statement that it has been met with in Kerry is not in itself improbable, and entomologists will be interested in having it confirmed; but when we find it said in the same paragraph that the insect is not uncommon in England, it will be received with doubt. *C. Dispar* has hitherto been found in only one locality in these islands, the neighbourhood of the fens formerly surrounding Whittlesea Mere. Other localities appear in works on entomology, but have never been authenticated. Owing partly to the drainage of the fens, and partly to the indefatigable efforts of dealers and other collectors, the insect has been quite extinct, I believe, for nearly twenty years.

Of late years the subdivision of species in entomology as well as in other departments of Natural History has been somewhat checked. What formerly appeared as those distinct species of *Polyommatus*, in our books of British Butterflies, under the names of Agestis, Artaxerxes, and Salmacis, are now all referred to the first-named species. Agestis is absent where Salmacis is found, and both where Artaxerxes is found, and the variety is referred to the difference of latitude. In the same way entomologists no longer recognise any specific distinction between *C. Dispar* and *C. Hippothoe*, widely-spread continental species. I possess a fine series of *C. Dispar* reared from larvæ taken in the year 1846. The spot in which they were found is close to the Holme station, 69 miles from London on the Great Northern Railway. They fed exclusively on the common water dock (*Rumex Palustris*). It is a curious illustration of the obscure causes which regulate the geographical range of species, that though the plant is abundant in the whole range of fen country, and generally throughout England, the butterfly was always confined to that immediate neighbourhood.

C. Virgaureæ was introduced into catalogues of British Lepidoptera on the authority of dealers, but its claims to be a British species were never authenticated.

Eton, Windsor. C. W. D.

The Brighton Aquarium

WOULD it be unduly troubling you were I to ask you to inform me, through the medium of the columns of NATURE, if the much-talked-of Brighton Aquarium is really to be "started"?

H. H. MOTT

The Cloaca Maxima

WILL you pardon me for asking a question which probably I ought to be able to answer myself? Mr. Corfield, in his interesting comparison of the hygienic performances of the ancients and ourselves, mentions the well-known Cloaca Maxima as one of the great glories of the Romans. Can he tell us how they got the sewage into it? I presume the invention of Bramah was not known in those times, and I was a little disappointed in not finding in his able paper a solution of a mystery which has puzzled me since my childhood. What did the Romans want with a Cloaca Maxima, and how did they use it?

Dec. 11th. IGNORAMUS

Lightning in a Clear Sky

THE following extract from the "Life of Charlemagne," by Eginhard, a contemporary, may be interesting to C. W. D. "Cum Carolus imperator ultimam in Saxoniam expeditionem contra Godefridum, regem Danorum, ageret, quadam die, cum, ante exortum solis, castris egressus, iter agere cœpisset, vidit repente delapsam cœlitus cum ingenti lumine facem a dextra in sinistram per serenum aera transcurrere; cunctisque hoc signum, quid portenderet, admirantibus, subito equus quem sedebat, capite deorsum merso, decidit, eumque tam graviter ad terram elisit, ut fibula sagi rupta balteoque gladii dissipato, a festinantibus qui aderant ministris exarmatus non sine adminiculo levaretur. Jaculum etiam quod tunc forte manu tenebat, ita elapsum est ut viginti vel eo amplius pedum spatio longe jaceret."

J. M. W.

NOTES

IT is stated that the Council of the British Association for the Advancement of Science have determined to ask the permission of the Lord President of the Council to appear before him as a Deputation, to urge upon the Government the need of a Royal Commission to inquire into the Present State of Science in England. We may congratulate ourselves that in Lord De Grey we have a Minister whose well-known large and scientific sympathies ensure a careful consideration of the important proposition to be laid before him.

MOST of our readers know ere this that the Government has determined not to fill up the appointment of the Mastership of the Mint vacant by the death of the lamented Graham. The duties are to be performed by Mr. Freemantle, who deserves all

praise for what he has done; and the Mint is, for the future, to be looked upon as an outpost of the Treasury. One hoped, seeing how rare are the scientific rewards in England, that a post that had been held by a Newton, a Herschel, and a Graham, might have been left as it was; but we hear that the Government have, in this case, some real justification for what they have done. In fact, it is the tendency shown by this action—a tendency to cut down everything, especially everything scientific—and not the action itself, which is more in question.

THERE is more and later news from Livingstone, who, judging from his letter to Dr. Kirk, published in the journals, is still weak in health. All we need give is his own idea of the work he has yet to accomplish:—"As to the work to be done by me, it is only to connect the sources which I have discovered from 500 to 700 miles south of Speke and Baker's with their Nile. The volume of water which flows north from latitude 12° south is so large, I suspect I have been working at the sources of the Congo as well as those of the Nile. I have to go down the eastern line of drainage to Baker's turning point. Tanganyika, Nyige Chowambe (Baker's?) are one water, and the head of it is 300 miles south of this. The western and central lines of drainage converge into an unvisited lake west or southwest of this. The outflow of this, whether to Congo or Nile, I have to ascertain. The people of this, called Manyema, are cannibals, if Arabs speak truly. I may have to go there first, and down Tanganyika, if I come out uneaten, and find my new squad from Zanzibar."

WE take a remarkable instance of resolute self-sacrifice from Mr. Hayward's account of the Turki rebellion against the Chinese dominion in 1863:—The Chinese garrison was shut up in the fort of Yarkand, and for 40 days besieged by the Turki army: the only terms offered were that all should embrace Islam. The old Amban—the Chinese Viceroy of Turkestan—summoned his officers to a council, held in an upper room, the lower room was piled with barrels of gunpowder, with a train leading from beneath the chair of state. The officers assembled, wrangling about the probable ransom that would be taken. The Amban's sons moved among them, offering tea and sweetmeats, his daughters knelt weeping by his side, he himself sat calmly smoking his long pipe. Suddenly cannon shots were heard, and the shouts of Allah Akhbar announced the advance of the enemy to storm. A hint of the Amban's resolution spread among the assembly, amidst the confusion he spoke a short farewell, and calmly turning his pipe-bowl, shed the embers on the train—and all was over.

WE learn that the account of Professor Jacobi's new process for the electro-deposit of iron, which has recently appeared in this country, does not include several improvements of great scientific interest which have recently been developed, an account of which we hope shortly to give.

THE following notice has been issued by desire of the Lord Chancellor:—"The electors to the Savilian Professorship—namely, the Archbishop of Canterbury, the Lord Chancellor of Great Britain, the Chancellor of the University of Oxford, the Lord Bishop of London, the Secretary of State for the Home Department, the Lord Chief Justices of the Queen's Bench and Common Pleas, the Lord Chief Baron of the Exchequer, the Dean of the Arches, and the Warden of New College (who may, if it be their pleasure, call into council the Vice-Chancellor of the University of Oxford)—will proceed to the election of a Savilian Professor on Thursday, the 10th day of February, 1870, or as soon thereafter as may be. All candidates are required to be of the full age of 26 years, and, if Englishmen, to be Masters of Arts at the least. The other regulations respecting the Savilian Professor may be seen in the University Statute sanctioned by Her Majesty the Queen in the year 1858. Candidates are to send their applications, addressed to Gordon Whitbread, Esq., 31, Great George Street, Westminster, S.W., on or before the 24th of January, 1870."

Here is another note from Oxford:—The examiners for the Radcliffe Travelling Fellowship—Dr. Acland, Dr. Rolleston, and Sir B. C. Brodie—have given notice that the next examination for a Fellowship will commence on Monday, January 31, at 10 a.m. Candidates are requested to send their names on or before Wednesday, January 19, by letter addressed to the Regius Professor of Medicine, Museum, Oxford.

THE exploration of the caves at Wellington, in the western district of New South Wales, under the direction of Mr. Krefft and Dr. A. M. Thomson, is making good progress, and many remains of extinct animals, some of which are new to science, have been discovered. A trial shaft is already put down in the centre of the Breccia cave, to the depth of fifteen feet, and bones are still found at that depth.

AS already stated in this journal, the University of Edinburgh has just made arrangements to enable ladies who wish to do so to study medicine. Those who avail themselves of the opportunity are taught in separate classes from those of the other medical students, each Professor at the University holding one class for men and another for women. Five lady students have already presented themselves for the medical matriculation examination. In London there is a "Female Medical Society," under the presidency of the Earl of Shaftesbury. The objects of the Female Medical Society are—"1. To promote the employment of properly educated women in the practice of midwifery, and the treatment of the diseases of women and children. 2. To provide educated women with proper facilities for learning the theory and practice of midwifery, and the necessary branches of medical science." To carry out these objects, the Society established a "Ladies' Medical College" five years ago, and eighty-two ladies have during that period availed themselves of the facilities it offered; most of them have since started in business, and are succeeding admirably.

DR. PETERMANN, of Gotha, the well-known German geographer, publishes an interesting article in the *Cologne Gazette* on the mission of Dr. Nachtigal to Central Africa. The latter was sent by the King of Prussia, on the 18th of February, 1869, to present Sultan Scheick Omar with some valuable gifts from King William, in recognition of the friendly reception given by the Sultan, in 1866, to Herr Gerhard Rohlfs and Herr Von Beuermann, an officer of the Prussian army. Dr. Nachtigal proceeded to Mursuk (near which place Miss Tinné was murdered), but finding that there was no prospect at present of reaching Bornu in safety, he proceeded on an expedition to Tibesti, in the Tibbu country, leaving the presents at Mursuk. Similar expeditions, says Dr. Petermann, have been undertaken by various eminent travellers during the last fifty years. In 1820 the Tibbu country was visited by Lyon; in 1822 by Denham, Clapperton, and Oudney; in 1853 by E. Vogel; in 1855 by Dr. Barth; in 1862 by Herr Von Beuermann; and in 1866 by Gerhard Rohlfs. Most of these attempted to go through Tibesti, but without success; and Dr. Nachtigal is the only European who has ever accomplished this dangerous feat. He left Mursuk on the 6th of June last, and returned on the 8th of October, after a series of wonderful adventures and escapes, which are related in a report addressed by him to Dr. Petermann, and now in the press.

THE Weekly Bulletin of the Scientific Association of France, dated the 12th instant, contains letters from Algeria recording a series of violent earthquake shocks experienced at Biskra, Seriana, and Sidi Okba, in the Province of Constantine. The disturbances extended from the 16th to the 19th of November, and appear to have been of a very alarming character. The fact

that no great damage was done to buildings is ascribed to the movement being chiefly vertical. The horizontal direction is stated by an observer to be from south-west to north-east, and by another from north-east to south-west.

SCHOPENAUER'S treatise on the "Philosophy of vision and colours," which originally appeared upwards of fifty years ago, and which has hitherto been treated with unmerited neglect by the great writers on physiological optics, has just reached a third edition. An interleaved and annotated copy of the second edition prepared by the author himself in 1854 was found amongst his papers, and has formed the basis for the present "improved and augmented" reissue, which appears under the editorship of Julius Frauenstädt.

WE desire to call special attention to the singularly interesting address of the new Rector of the University of Vienna, Carl von Littrow, on a subject which does not at first sight appear to be of a very interesting character, viz., the backwardness of the ancients in the sciences. This backwardness he ascribes, firstly, to an actual want of the power of accurate observation; and, secondly, to a restless spirit of speculation. The illustrations of these positions are drawn from astronomy, the science to which in early times the greatest care was devoted. Of the instances adduced to show that the ancients, notwithstanding their fine feeling for form, evidenced in the remains of classic art, had not even the most primitive power of observation, we may mention the following. According to the elder Pliny, whose estimate is very much higher than those of Hipparchus and Ptolemy as recorded in the Almagest, the number of fixed stars is 1,600; whereas, in our own day, Argelander, working in such a comparatively unfavourable climate as Bonn, records on his maps no less than 3,256 stars visible to the naked eye. Again, Argelander gives nineteen as the number of nebulæ and star-clusters visible in our latitudes, while Hipparchus mentions only two, and Ptolemy but five; both of these observers entirely passing over such remarkable objects as the nebulæ in Orion and in Andromeda. The group of the Pleiades was considered of great importance for ancient navigation, and was constantly watched; and yet only seven of its stars were discovered. Indeed most of the early observers could only see six; the seventh was lost sight of for centuries; and ultimately, when the middle star in the tail of the Great Bear first attracted attention, the conclusion arrived at was that the latter was the missing seventh star of the Pleides. Nowadays cases are known of people who are not astronomers seeing from fourteen to sixteen stars in the Pleiades; and it is by no means uncommon for persons of good sight to see eleven. The star ω in Capricornus was seen by man for thousands of years without its being noted that it is a double star, a fact that any child would discover now if its attention were directed to it. It would be interesting to know what is the capacity of individuals of savage races as regards discriminating celestial objects. Light might then be thrown upon the question, how far the observational defects of the early astronomers were due to mere carelessness, and how far we inherit a schooled eye from generations of ancestors who gradually accustomed themselves to the accurate discrimination of external objects.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 9.—Dr. W. A. Miller, V.P., in the chair. The following papers were read:—

"Spectroscopic Observations of the Sun."—No. V. By J. Norman Lockyer, F.R.S.

The author first referred to several new facts of importance as follows:

"I. The extreme rates of movement in the chromosphere observed up to the present time are—

Vertical movement	40 miles a second
Horizontal or cyclonic movement .	120 ,,

"II. I have carefully observed the chromosphere when spots have been near the limb. The spots have sometimes been accompanied by prominences, at other times they have not been so accompanied. Such observations show that we may have spots visible without prominences in the same region, and prominences without spots; but I do not say that a spot is not accompanied by a prominenee *at some stage of its life*, or that it does not result from some action which, in the majority of cases, is accompanied by a prominence.

"III. At times, when a prominence is seen bright on the sun itself, the bright F line varies considerably, both in thickness and brilliancy, within the thickness of the dark line. The appearances presented are exactly as if we were looking at the prominences through a grating.

"IV. Bright prominences, when seen above spots on the disk, if built up of other substances besides hydrogen, are indicated by the bright lines of those substances in addition to the lines of hydrogen. The bright lines are then seen very thin, situated centrally (or nearly so) on the broad absorption-bands caused by the underlying less-luminous vapours of the same substances.

"V. I have at last detected an absorption-line corresponding to the orange line in the chromosphere. Father Secchi states* that there is a line corresponding to it much brighter than the rest of the spectrum. My observation would seem to indicate that he has observed a bright line less refrangible than the one in question, which bright line is at times excessively brilliant. It requires absolutely perfect atmospheric conditions to see it in the ordinary solar spectrum. It is best seen in a spot-spectrum when the spot is partially covered by a bright prominence.

"VI. In the neighbourhood of spots the F bright line is sometimes observed considerably widened out in several places, as if the spectroscope were analysing injections of hydrogen at great pressure in very limited regions into the chromosphere.

"VII. The brilliancy of the bright lines visible in the ordinary solar spectrum is extremely variable. One of them, at 1871·5, and another, at 1529·5 of Kirchhoff's scale, I have detected in the chromosphere at the same time that they were brilliant in the ordinary solar spectrum.

"VIII. Alterations of wave-length have been detected in the sodium-, magnesium-, and iron-lines in a spot-spectrum. In the case of the last substance, the lines in which the alteration was detected were *not* those observed when iron (if we accept them to be due to iron alone) is injected into the chromosphere.

"IX. When the chromosphere is observed with a tangential slit, the F bright line close to the sun's limb shows traces of absorption, which gradually diminish as the higher strata of the chromosphere are brought on to the slit, until the absorption-line finally thins out and entirely disappears. The lines of other substances thus observed do not show this absorption.

"X. During the most recent observations, I have been able to detect traces of magnesium and iron in nearly all solar latitudes in the chromosphere. If this be not merely the result of the good definition lately, it would indicate an increased general photospheric disturbance as the maximum sunspot period is approached. Moreover, I suspect that the chromosphere has lost somewhat of its height."

The author appends a list of the bright lines, the position of which in the chromosphere have been determined absolutely, with the dates of discovery, remarking that in the case of C and F his observations were anticipated by M. Janssen:—

Hydrogen

C. October 20, 1868.
F. October 20, 1868.
near D. October 20, 1868.*
[* *Hydrogen?*—G. G. S.]
near G. December 22, 1868.
h. March 14, 1869.

Sodium

D. February 28, 1869.

Barium

1989·5† March 14, 1869.
2031·2 July 5, 1869.

Magnesium and included line

b^1, b^2, b^3, b^4 } February 21, 1869.

* *Comptes Rendus*, 1869, 1 sem. p. 358.
† This reference is to Kirchhoff's scale.

Other Lines.

Iron	1474.	June 6, 1869.
?	1515·5.	June 6, 1869.
Bright line	1529·5.	July 5, 1869.
?	1567·5.	March 6, 1869.
?	1613·8.	June 6.
Iron	1867·0.	June 26.
Bright line	1871·5.	,,
Iron	2001·5.	,,
?	2003·4.	,,
? band or line near black line, very delicate . . .	2054·0.	July 5.

Other lines besides these have been seen at different times; but their positions have not been determined absolutely.

The author points out that taking iron as an instance, and assuming that the iron-lines mapped by Ångström and Kirchhoff are due to iron only, he has only been able, up to the present time, to detect three lines out of the total number (460) in the spectrum of the lower regions of the chromosphere,—a fact full of promise as regards the possible results of future laboratory work. The same remark applies to magnesium and barium.

The paper then proceeded as follows:—

"Dr. Frankland and myself have determined that the widening out of the sodium-line in the spectrum of a spot which I pointed out in 1866, and then stated to be possibly an evidence of greater absorption, indicates a greater absorption due to greater pressure.

"The continuous widening out of the sodium-line in a spot must therefore be regarded as furnishing an additional argument (if one were now needed) in favour of the theory of the physical constitution of the sun first put forward by Dr. Frankland and myself—namely, that the chromosphere and the photosphere form the true atmosphere of the sun, and that under ordinary circumstances the absorption is continuous from the top of the chromosphere to the bottom of the photosphere, at whatever depth from the bottom of the spot that bottom may be assumed to be.

"This theory was based upon all our observations made from 1866 up to the time at which it was communicated to the Royal Society and the Paris Academy of Sciences, and has been strengthened by all our subsequent work; but several announcements made by Father Secchi to the Paris Academy of Sciences and other learned bodies are so opposed to it, and differ so much from my own observations, that it is necessary that I should refer to them, and give my reasons for still thinking that the theory above referred to is not in disaccord with facts.

"Father Secchi states that the chromosphere is often separated from the photosphere, and that between the chromosphere and the photosphere there exists a stratum giving a continuous spectrum, which he considers to be the base of the solar atmosphere, and in which he thinks that the inversion of the spectrum takes place.

"With regard to the first assertion, I may first state that all the observations I have made have led me to a contrary conclusion. Secondly, in an instrument of comparatively small dispersive power, such as that employed by Father Secchi, in which the widening out of the F line at the base of the chromosphere is not clearly indicated, it is almost impossible to determine, by means of the spectroscope, whether the chromosphere rests on the sun or not, as the chromosphere is an envelope and we are not dealing merely with a section. But an instrument of great dispersive power can at once settle the question; for since the F line widens out with pressure, and as the pressure increases as the sun is approached, the continuous curvature of the F line must indicate really the spectrum of a section; and if the chromosphere were suspended merely at a certain height above the photosphere, we should not get a widening due to pressure: but we always do get such a widening.

"With regard to the second assertion, I would remark that if such a continuous-spectrum-giving envelope existed, I entirely fail to see how it could be regarded as a region of selective absorption. Secondly, my observations have indicated no such stratum, although injections of sodium, magnesium, &c. into the chromosphere not exceeding the limit of the sun's limb by 2″ have been regularly observed for several months past. To-day I have even detected a low level of barium in the chromosphere not 1″ high. This indicates, I think, that my instrument is not lacking in delicacy; and as I have never seen anything approaching to a continuous spectrum when my instrument has been in perfect adjustment, I am inclined to attribute the observation to some instrumental error. Such a phenomenon might arise from a local injection of solid or liquid particles into the chromosphere, if such injection were possible. But I have never seen such an injection. If such an occurrence could be observed, it would at once settle that part of Dr. Frankland's and my own theory, which regards the chromosphere as the last layer of the solar atmosphere; and if it were possible to accept Father Secchi's observation, the point would be settled in our favour.

"The sodium experiments to which I have referred, however, and the widening out of the lines in the spot-spectra, clearly indicate, I think, that the base of the atmosphere is below the spot and not above it. I therefore cannot accept Father Secchi's statement as being final against another part of the theory to which I have referred—a conclusion which Father Secchi himself seems to accept in other communications.

"Father Secchi remarks also that the F line is produced by the absorption of other bodies besides hydrogen, because it never disappears. This conclusion is also negatived by my observations; for it has very often been observed to disappear altogether and to be replaced by a bright line. At times, as I pointed out to the Royal Society some months ago, when a violent storm is going on accompanied by rapid elevations and depressions of the prominences, there is a black line on the less-refrangible side of the bright one; but this is a phenomenon due to a change of wave-length caused by a rapid motion of the hydrogen.

"With regard to the observation of spot-spectra, I find that every increase of dispersive power renders the phenomenon much more clear, and at the same time more simple. The selective absorption I discovered in 1866 comes out in its most intense form, but without any of the more complicated accompaniments described by Father Secchi. I find, however, that by using three prisms this complexity vanishes to a great extent. We get portions of the spectrum here and there abnormally bright, which have given rise doubtless to some of the statements of the distinguished Roman observer; but the bright lines, properly so-called, are as variable as they are in any other part of the disk, but not much more so. I quite agree that the 'interpretation' of sun-spot phenomena to which Father Secchi has referred,* which ascribes the appearances to anything but selective plus general absorption, is erroneous. But as I was not aware that it had ever been propounded, I can only refer to my own prior papers in support of my assertion which were communicated to the Royal Society some three years ago."

"Researches on Gaseous Spectra in relation to the Physical Constitution of the Sun, Stars, and Nebulæ."—Third Note. By E. Frankland, F.R.S., and J. Norman Lockyer, F.R.S.

The authors remark that it has been pointed out by Mr. Lockyer that the vapours of magnesium, iron, &c., are sometimes injected into the sun's chromosphere, and are then rendered sensible by their bright spectral lines. (Proc. Roy. Soc., vol. xvii. p. 351.)

2. It has also been shown (1) that these vapours, for the most part, attain only a very low elevation in the chromosphere, and (2) that on rare occasions the magnesium vapour is observed like a cloud separated from the photosphere.

3. It was further established on the 14th of March, 1869, and a drawing was sent to the Royal Society indicating, that when the magnesium vapour is thus injected, the spectral lines do not all attain the same height.

Thus, of the b lines, b^1 and b^2 are of nearly equal height, but b^4 is much shorter.

4. It has since been discovered that of the 450 iron lines observed by Ångström, only a very few are indicated in the spectrum of the chromosphere when iron vapour is injected into it.

5. The authors' experiments on hydrogen and nitrogen enabled them at once to connect these phenomena, always assuming that the great bulk of the absorption to which the Fraunhofer lines are due takes place in the photosphere itself.

It was only necessary, in fact, to assume that, as in the case of hydrogen and nitrogen, the spectrum became simpler where the density and temperature were less, to account at once for the reduction in the number of lines visible in those regions where, on the authors' theory, the pressure and temperature of the absorbing vapours of the sun are at their minimum.

6. It became important, therefore, to test the truth of this assumption by some laboratory experiments, the preliminary results of which are communicated in this note.

* *Comptes Rendus*, 1869, 1 sem. p. 764.

The spark was taken in air between two magnesium poles, so separated that the magnesium spectrum did not extend from pole to pole, but was visible only for a little distance, indicated by the atmosphere of magnesium vapour round each pole.

The disappearance of the *b* lines was then examined, and it was *found that they behaved exactly as they do on the sun.* Of the three lines, the most refrangible was the shortest; and shorter than this were other lines, *which Mr. Lockyer has not detected in the spectrum of the chromosphere.*

This preliminary experiment, therefore, quite justified the assumption, and must be regarded as strengthening the theory on which the assumption was based, namely, that the bulk of the absorption takes place in the photosphere, and that it and the chromosphere form the true atmosphere of the sun. In fact, had the experiment been made in hydrogen instead of in air, the phenomena indicated by the telescope would have been almost perfectly reproduced; for each increase in the temperature of the spark caused the magnesium vapour to extend further from the pole, and where the lines disappeared a band was observed surmounting them, which is possibly connected with one which at times is observed in the spectrum of the chromosphere itself when the magnesium lines are not visible.

Professor Williamson communicated a paper "On the successive Action of Sodium and Iodide of Ethyl on Acetic Ether," by J. Alfred Wanklyn, F.C.S. The author referred to a paper by Frankland and Duppa, describing the products obtained on treatment with iodide of ethyl of the yellow wax-like mass given by the action of sodium on acetic ether. Besides the description of the compounds, Frankland and Duppa gave four equations expressive of their view of the origin of the wax-like mass: each one of these four equations affirmed the evolution of an equivalent of hydrogen by every equivalent of sodium employed; but according to Mr. Wanklyn neither acetic ether nor any other ether ever evolves hydrogen by reaction with the alkali metals. All equations which assume evolution of hydrogen in these reactions are therefore inadmissible. In the present paper Mr. Wanklyn offers an explanation of Frankland and Duppa's products, which does not involve the assumption of evolution of hydrogen. On reference to Frankland and Duppa's paper just cited, it will be found that the products described by them as obtained from the "wax-like mass" and iodide of ethyl are the following:—

A. $C_8\ H_{14}\ O_3$, liquid boiling at 195° C.,
B. $C_{10}\ H_{18}\ O_3$, liquid boiling at 210° C. to 212° C.,

butyric ether, caproic ether, and also some unacted-upon acetic ether, and a considerable quantity of common ethylic ether. Mr. Wanklyn has already shown that the direct products of the action of sodium on acetic ether are ethylate of sodium and sodium-triacetyl. Nothing else seems to be produced directly. But the excess of acetic ether, which is necessarily taken, acts on some of the ethylate of sodium, producing alcohol and acetate of ethylene-sodium, the extent to which this secondary action takes place being determined by the exact circumstances of the experiment. We have, therefore, in the wax-like mass got by prolonging the action of sodium on acetic ether:—

Ethylate of sodium	$C_2\ H_5\ NaO$
Sodium-triacetyl	$C_6\ H_9\ O_3\ Na$
Acetate of ethylene-sodium . . .	$C_4\ H_7\ Na\ O_2$
Alcohol	$C_2\ H_6\ O$.

On the first three iodide of ethyl acts, giving iodide of sodium and organic liquids. From the ethylate of sodium comes the common ether. From the sodium-triacetyl comes ethyl-triacetyl, which is $A = C_8\ H_{14}\ O_3$, having been got by Geuther from the pure sodium-triacetyl. From isolated acetate of ethylene-sodium and iodide of ethylene Mr. Wanklyn has recently obtained liquid B, $C_{10}\ H_{18}\ O_3$. This liquid boiled at 212° C. and gave carbonate of baryta with baryta-water, and was identical with Frankland and Duppa's liquid B. By the action of liquid A upon ethylate of sodium Geuther has recently shown that butyric ether is produced together with acetate of ethylene-sodium, and Mr. Wanklyn predicts that liquid B will give caproic ether by a similar reaction.

Royal Geographical Society, December 13, Sir R. Murchison in the chair. The President made some comments on the recent letter from Dr. Livingstone, whose return would, he thought, very probably be delayed by the exploration of the waters, which might prove the head waters of the Congo. The paper of the evening was Mr. Hayward's account of his visit to Eastern Turkestan; a large map constructed by Captain George, from the maps and observations sent home by Mr. Hayward, and two views, enlarged from sketches taken by him on the spot, illustrated the paper. Dr. Leitner's collection of Yarkandi manufactures was also exhibited, and the presence of Niaz Muhammed, the native of Yarkand, excited much interest. Mr. Hayward has carefully fixed all the positions in the maps sent home by him, and also sent itineraries, list of names, and plans of towns. He mentioned the valuable pocket artificial horizon invented by Captain George, which enabled him to escape suspicion. Mr. Hayward left Leh Sept. 29, and proceeded by the Chang Chennoo Pass, 18,839 feet high, to Shadula, in lat. N. 36° 21′ 11″, long. E. 78° 18′, 360 miles from Leh, the frontier fort of Eastern Turkestan, 14,745 feet high, which is divided from the dominions of the Maharajah of Kashmir by the Karakorum range. Mr. Shawhad, unknown to Mr. Hayward, arrived a few days before. The travellers were detained while a messenger was sent forward to obtain permission for them to enter the country. The opportunity was taken to explore the sources of the Yarkand Daria, beyond the Khirgiz Pass, 17,095 feet high. From this a view of the Eastern Kuen Luen peaks was obtained, 90 miles away, the course of the river was traced and positions proved. A new pass, called the Yangi Pass, over the Kuen Luen, was observed, and described as practicable for horses, and easily made practicable for carriages, and even for guns. It is at present exposed to the depredations of robbers from Hunza Nagyr, which render it insecure and little used. Twenty days were spent in this exploration, and 300 miles of mountain districts explored. One peak rising to 28,278 feet, was observed from a spur of Kuen Luen Mountains. The source of the Yarkand River, in lat. 35° 37′ 34″ N., long. 77° 50′ E., was reached on December 8th. At a height of 16,654 feet above the sea, the cold experienced was intense. The thermometer the following morning showed the mercury to have sunk to a level with the bulb, or 18° below zero. Having returned to Shadula, he found that permission had come for his advance to Yarkand, and started on December 18th to reach that place by the Sanju Pass. Mr. Hayward described the Khirgizes, the Bedouins of Turkestan, from whom he experienced kindness and hospitality, as throughout the country seems to have been the case. From Shadula yaks were provided, on which the travellers crossed the Sanju Pass. The first village entered was Kibriz. The Turhi villages present a comfortable appearance. The country is well cultivated, and the people well to do. The dress, &c., of the different classes was carefully described. Slaves are still owned by some; but the former slave trade at Yarkand has been suppressed by Yakoob Kushbegi. Between Sanju and Yarkand a sandy steppe was crossed, the commencement of a desert called Tahla Makân Desert, stretching to the east, towards the Gobi Desert. Strange legends of former cities, now buried in the sand, were related by the Panja Bashi. Yarkand was entered on December 27th. It is described as a parallelogram of 2 miles by 1½, containing 40,000 houses, 120 mosques, and 120,000 inhabitants. It is defended by mud walls 45 feet high, with bastions, and an outlying fort. The ruler of Yarkand, Muhammed Yakoob (Kashbegie), "Atalih Ghazee" of Eastern Turkestan, was at his camp near Kashkar. The governor of the city, "a well-informed, pleasant, well-read man," received Mr. Hayward with much courtesy. A house was assigned him, and plentiful supplies furnished him; but he was not allowed, except on visits to the governor, to leave the courtyard of his house during the two months he remained in Yarkand.

February 24th, Mr. Hayward proceeded to Kashkar, which is a strong town of 60,000 to 70,000 people, the central point of all the Central Asia roads. The next day he was received by the ruler, who by his bravery and military talents has raised himself to the chief authority over Eastern Turkestan. His character and abilities impressed Mr. Hayward so much, that he says, were Central Asia undisturbed by foreign pressure, he would be another Zenghis Khan. He received the traveller kindly, and spoke of his desire for visits from Englishmen, who had been hitherto prevented from visiting his country by the Bokhara tragedy. He also alluded to the death of Adolph Schlagintweit, but did not mention that he had himself killed Hullee Khan, the murderer of Schlagintweit, two years ago. Mr. Hayward remained a month in Kashkar, vainly hoping to get permission to proceed to the Pamir Steppe, but was obliged to abandon the attempt. The position of Kashkar was fixed by him at

City	39° 19′ 37″	N. lat.
Fort	39° 23′ 9″	

and 76° 10′ E. long., at an elevation of 4,165 feet. He concluded

by some account of the revolt against the Chinese dominion, which, after lasting a hundred years, was overthrown in 1863; after which the present ruler, with his Uzbeg troops, defeated the Tunganis, and successively made himself master of the different places, and is now master of the country. But his tenure is precarious, and his fear of assassination causes him to change his apartment every hour during the night.—In the ensuing discussion, the president stated that, so far from Russia regarding our commercial entrance into Eastern Turkestan with jealousy, the Czar and Prince Gortschakoff had both assured Mr. Forsyth that so long as the Atalih Ghazee confined himself to the country south of the Tian Shan, Russia would not interfere with Eastern Turkestan.—The president also pointed out that Mr. Hayward's discoveries had confirmed A. von Humboldt's theory as to the salient points of the mountain systems of Central Asia. Mr. Hayward was about starting to explore the Pamir Steppe, by way of Ghilghit.—Sir H. Rawlinson mentioned that he was enabled to state that the Indian Government were about to arrange with the Maharajah of Kashmir, to send officers to survey the routes to the frontier of Turkestan; and intended afterwards to enter into negotiations with the Atalih Ghazee for the same purpose, as to the routes in his dominions. It is understood that Russia has not recognised the Atalih Ghazee, regarding him as a rebel against the empire of China—an ally of Russia.

Royal Microscopical Society, December 8.—The Rev. J. B. Reade, M.A., F.R.S., president, in the chair. Prof. Rymer Jones, F.R.S., read a paper on Deep-sea Dredgings from China and Japan. Professor Jones stated that he had recently received from Lieut. Ross, R.N. (grandson of Sir J. Ross), certain specimens of deep-sea dredgings, obtained at a depth of 1,080 fathoms, from the bottom of the sea near Fly Island, in the neighbourhood of Sandal-wood Island. After alluding to the theories which had until a recent period prevailed with respect to the depth at which animal life existed in the ocean, and to the researches and discoveries of Prof. Forbes, Sir. J. Ross, and Dr. Wallich, Prof. Jones proceeded to give a description of the contents of a phial (a small portion of the dredgings sent by Lieut. Ross), from which about a grain and a half of solid matter had been obtained. The first result of the microscopic examination of this matter was the discovery of a considerable quantity of silex, so finely triturated, however, as to be scarcely visible. The next discovery was a large number of sponge *spiculæ;* many of the spicules being sculptured in forms of the greatest beauty. Of these spicules there were 12 genera. Some 800 or 900 specimens of *Foraminifera* were next found, exhibiting nearly every form of the animal hitherto found in the bed of the Atlantic. A still more interesting discovery was that of 600 or 700 *Polycystinæ;* which differed from those found in Barbadoes, in this respect, that whereas the latter were usually brought up fractured and imperfect, the former were perfectly intact in all parts, displaying the most exquisite structures, and hundreds being clothed in thin soft covering. From this fact it might be argued that they had been taken from their ocean home alive, notwithstanding the immense pressure to which they are said to be subjected. There were also many species present which had not as yet received names from naturalists. Besides these, Prof. Jones had found a large number of shields of various shapes, resembling the *Diatomaceæ;* and of these there were not less than 300. Lastly, he had found diatoms themselves, more sparsely distributed, but of larger size than those usually coming under the notice of microscopists; and of these there were over fifty specimens. What larger animals lived at the bottom of the deep sea he could not say, but as there appeared to be abundant food for them, and as both Sir J. Ross and Dr. Wallich had found star-fishes in the respective localities dredged by them, it might be reasonably inferred that they abounded in the ocean bed, and that a most extensive fauna existed there as yet entirely undiscovered. The following papers, for want of time, were taken as read, viz.: "On the Stylet Region of the Ominontoplean Broboscis," by Dr. McIntosh, and "Organisms in Mineral Infusions," by C. Staniland Wake, F.A.S.L. Four gentlemen were elected Fellows, and the Society adjourned to January 12, 1870.

Entomological Society, December 9.—Mr. H. W. Bates, president, in the chair. Seven new members were elected, namely, MM. d'Emerich, De Marseul, and Oberthur (foreign members), Captain Lang, R.E., and Messrs. W. Arnold Lewis, J. Cosmo Melvill, and Howard Vaughan. Exhibitions of *Hymenoptera* were made by Prof. Westwood and Mr. Frederick Smith; of *Lepidoptera*, by Mr. F. Smith and Mr. J. Jenner Weir; of *Coleoptera*, by Prof. Westwood and Mr. Albert Müller. Communications were read from Mr. Robert McLachlan on *Borcus hymenalis* and *B. Westwoodii;* from Mr. Edwin Brown, respecting the locust captured at Burton-on-Trent and exhibited at the previous meeting, which had been identified as *Acridium peregrinum*, a species distributed over a great part of Asia and the North of Africa, but not hitherto detected in Europe.

Ethnological Society, December 7.—Prof. Huxley, LL.D., F.R.S., president, in the chair. At the meeting of the International Congress for Prehistoric Archæology, held last year at Norwich, a committee was formed, under the presidency of Sir John Lubbock, Bart., for the purpose of inquiring into the present condition of the prehistoric remains in the British Isles. Subsequently, the functions of this committee were transferred to the Ethnological Society, and the first-fruits of its labours in this direction have just appeared in the shape of a valuable Report on the Prehistoric Monuments of the Channel Islands, prepared by Lieut. Oliver, R.A. These islands are remarkably rich in megalithic structures of noble proportions, but from their unprotected state they have been subject to the most ruthless destruction. Not only have they been demolished by the "navvy" and the mere treasure-seeker, but they have also suffered considerably from injudicious attempts at restoration. Nevertheless, they are still sufficiently numerous to form the subject of an elaborate Report. Lieut. Oliver pointed out the resemblance between some of these megalithic monuments and those in Madagascar erected at the present day by the hill-tribes of Hovas. The Report was copiously illustrated; and called forth a discussion, in which the chief speakers were the president, Mr. J. Lukis, Mr. J. W. Flower, Dr. Hyde Clarke, and Col. Lane-Fox.—At the same meeting, a note was read from Mr. Acheson on a supposed stone implement, found beneath the bed of a river worked for gold in Co. Wicklow.—A communication was also made, by Maj.-General Lefroy, on the Stature of the North-American Indians of the Chipewyan Tribe; and remarks were made upon it by Dr. Richard King.

Anthropological Society, December 7.—Dr. Beddoe, president, in the chair. Dr. Leitner gave some further details of his visit to Dardistan in 1866, especially referring to the Shina race. He briefly touched upon the main outlines of his journey, mentioning that his experience had modified his views as to the inconvenience resulting from the rarefaction of the air at high altitudes, inasmuch as he and his companions had surmounted passes of 18,000 feet without experiencing any of the usual effects. Although the Dards were at war with the Maharajah of Kashmir, and the towns apparently deserted, he was able to assemble, by sending round a drummer, 150 to a feast, and continued on most friendly terms with them during his abode in Ghilghit. The vocabularies and grammars of the hitherto unwritten Dardoo dialects which he has collected show a probably parental Aryan type. It is to be much regretted that the refusal of the India Office to grant an extension of leave to Dr. Leitner will compel his return to India within a fortnight, and almost deprive him of the opportunity of arranging and comparing these hitherto unknown languages. The Indian Government does not seem desirous of encouraging acquaintance with Central Asia. A traveller desirous of penetrating by Ghilghit to the Panin Steppe had recently been refused mules. Several interesting particulars of the customs among the Chilasis Ghilghites and other Dards were mentioned, which are alien to Mahommedan and Hindu ideas. The place and privileges accorded to women, who receive the visits of their husbands' friends without any suspicion—the custom of courtship, the use of wine, the fondness for dogs,—all seem to point to an independent origin of religion and manners. The value set upon dogs was illustrated by the fact that two men-slaves were given as the price of a good hound. The Sooni ruler of Chitral not merely sold his subjects, but his own mother, as a slave, and when asked how he could sell her whose breasts had suckled him, pointed to a cow, and said that she gave him milk constantly, yet he would sell her! and when a Moollah, who was to be sold, threatened him with vengeance for selling a minister of the Word of God, he replied that everybody sold the Koran—why therefore should he not sell the expounder of it. Dr. Leitner stated that the Kafirs were certainly fairer than the Kashmiris, but his experience hardly bore out the statement of their being exceptionally fair, with blue eyes and light hair. West of Balti the general type of face approximated more to the European. He could discover no religion or rites among them, save that once a year each deposited a stone on a cairn, situated on a high mountain. He found a species of caste division among the

Shinas, but the different castes intermarry and eat together. He narrated a curious Shina legend of a Shinari who fell in with a company of one-eyed demons, and was a witness of a demoniacal wedding. A very numerous and interested assembly listened with marked approval; and in reply to various questions, Dr. Leitner further stated that he had not remarked any megalithic or Druidic remains. The countries were traversed by him rather with a view to linguistic and philological discoveries. The houses were meanly constructed; the food evinced a rough skill in cookery; every Dard family seemed to possess a cavern, the secret of which was known only to them, and they thus had plentiful supplies of food, which they shared with him, while the Maharajah's sepoys were starving. Strong opinions were expressed as to the refusal of extension of leave to Dr. Leitner, and a resolution was unanimously passed calling upon the Government to take measures to aid and encourage travellers to visit these little-known regions of Central Asia. It is to be hoped that some means may be found to prolong the visit of Niar Mahommed, the Yarkandi, and both obtain from him information, and give him lasting impression of our resources and hospitality. We should not omit to mention that Dr. Leitner altogether denied the statement quoted from the *Invalide Russe*, that he had visited Herat or taken part in the battle of Samarcand.

Philological Society, December 3.—Mr. A. J. Ellis, F.R.S., in the chair. Mr. A. Melville Bell read a paper on Pronouncing all Languages. He showed how all the vowels could be produced: first, by placing the tongue in nine different positions, by means of which the extent and form of the neck which unites the front with the back cavity of the mouth was modified; secondly, by increasing or diminishing the whole of the cavities behind this neck; thirdly and fourthly, by altering the form of the cavities in front of the neck in the two former cases, by the action of the lips. The thirty-six vowels thus produced practically covered all known vowel sounds. He also showed how the consonants could be produced by three positions of the tongue and one of the lips, modified in six definite manners, allowing voice or breath to pass through a simple narrow orifice with central aperture, or a compound orifice of the same description, or a double simple or compound orifice, the central passage being stopped, and emission of voice taking place at the sides; or else by stopping breath or voice altogether, or allowing them to pass through the nose. He also explained how these forty-eight consonants could be varied, producing, with the glottal and nasal actions, all the possible varieties of articulation. He illustrated his paper by diagrams and models of his symbols, by which in each case he made the precise position of the organs of speech necessary for producing each sound visible on paper in a single definite and intelligible letter. He informed the Society that these letters had been most effective in teaching little children who had been born deaf and dumb to articulate and distinguish vowel sounds with accuracy; a statement which the chairman confirmed from personal knowledge of Miss Hull's school for deaf and dumb girls, 102, Warwick Gardens, Kensington. The meeting unanimously passed the following resolution: "That this meeting of the Philological Society desires to express its strong sense of the beauty and great value of Mr. A. M. Bell's system of Visible Speech, and its ready applicability to purposes of philological investigation."

Institution of Civil Engineers, December 7.—Mr. C. W. Gregory, president, in the chair. The first paper read was on the Public Works of the Province of Canterbury, New Zealand, by Mr. Edward Dobson, Assoc. Inst. C.E. In this communication a history was given of the Public Works Department of Canterbury, from its establishment, in 1854, to the completion of the railways, in 1868. During that period the survey of the province, commenced under the "Canterbury Association," had been completed by the officers of the Survey Department; the eastern portion of the province had been thrown open to settlement, by the construction of many hundred miles of metalled roads; the western goldfields had been connected with the capital, by a coach-road through the passes of the New Zealand Alps—a road remarkable both for the boldness of its design and the circumstances under which it was executed; and a complete system of railroad had been surveyed, the key to which (a tunnel 129 chains in length through the crater wall of Lyttleton Harbour) had been successfully completed. Extensive harbour works had been constructed, public buildings erected in the principal towns, and telegraph and postal services carried to a fair state of organisation. The total expenditure on public works and surveys during the period referred to had been, in round numbers, 1,800,000*l.*, out of a total Government expenditure of about 8,880,000*l.* The population in 1854 was about 6,000; in 1868 it amounted to 54,000, including the mining population of the county of Westland. The great bulk of the public works of Canterbury possessed but little professional interest—the country being level, and the bridges chiefly of timber of ordinary construction. Many of the rivers run on ridges above the general surface of the plains, and in dealing with them it was essential to leave abundant waterway, as there was little chance of any ordinary embankment standing against such torrents as they sometimes carried. Paradoxical as it might appear, the portions of the proposed railways which were to traverse the level plains would require heavy earthworks, while the lines through the ranges, being contoured on the hill-sides, would be carried for miles on surface gradients with light side-cutting through a mountainous and difficult country. The principal works executed by the Government were: first, the Summer Road from Lyttelton to Christchurch, which was scraped out of the cliffs for a continuous length of several miles; second, the West Coast Road, from Christchurch to Hokitika, which was constructed in nine months, through a hundred miles of rough and difficult country, totally uninhabited, and for the most part densely timbered; third, the Moorhouse Tunnel, on the line of the Lyttelton and Christchurch Railway, 2,861 yards in length, driven through the crater of an extinct volcano under a summit level 1,220 feet above the sea; and fourth, the wharf and jetties at the Lyttelton station, built upon a soft mud-bank which was, in places, 50 feet in depth. In laying out roads on hilly ground, the principle uniformly adopted was to follow the windings of the spurs, contouring the gradients with the spirit-level, so as to minimize both cutting and embankment, and to dispense with culverts as far as possible. In the case of side cuttings, the gradient was contoured with the spirit-level and lock-spitted. The back line of the floor of the cutting was thus ranged out, and the depth of the cutting measured at every half-chain. The width of the slope was then calculated and set off, and the back line of the slope lock-spitted. The work could then be let by contract at any future time when the funds might be voted by the council, no plans or sections being required, or any details, beyond the rate of slope, the total length of the cutting, and its cubic content. A serious difficulty in the conduct of the road works was the want of timber. The expedient adopted was to keep constantly in stock a quantity of planks, 16 feet 8 inches long, and 8 inches by 3 inches in section, and the bridges and culverts were built on standard patterns designed with reference to this unit of material. This plan effected a great saving of office labour, as no drawings were required in ordinary cases; and as three planks made up 100 feet (board measure), any labourer was competent to take an account of the timber used, all that was necessary being to count the number of planks. Amongst the road bridges there were few that presented special interest, with, however, two exceptions. These were: first, a drawbridge over the Waimakariri River, built on the telescope principle, from a simple design, and which worked satisfactorily; and, secondly, a bridge over the Taipo River, on the West Coast Road, presenting several peculiarities of construction. The Harbour Works possessed considerable interest, which was enhanced by their partial failure. It was found that the mud-bank was too soft to support the screws of the screw-pile jetty, and, accordingly, additional lengths of piles were cast, and a solid core of hard wood placed in the bottom of each pile, and driven down to the solid rock, on which the weight of the structure was made to rest; the flanges of the screws simply acting as supports to check lateral vibrations. The diagonal bracing was put in by divers without difficulty, the exact length of each brace being taken from a template applied by the diver to the work after the piles were screwed down to their proper depth. The sea-wall slipped forward in two places during the progress of the work, the total amount of forward movement in each case being between 5 feet and 6 feet. The author did not consider that any advantage would have been gained by carrying the piles down to the solid rock, as, in all probability, the outward movement of the embankment would in that case have overturned the work and destroyed it. He thought that the partial failure of the work might be attributed to two causes: first, that the stone embankment was deficient, both in bulk and weight, for the duty it had to perform; and, secondly, that the tipping of the clay embankment was commenced before the stone embankment had had time to take a solid bearing, so as to form an abutment to

resist the pressure of the backing. The work had since been completed, by driving an outer row of piles and putting in fresh capsills, jointing, and planking; and locomotives had been running for twelve months over the embankment without any further slipping, or more than the ordinary amount of settlement. It was worthy of notice, that no effect whatever was produced upon the sea-wall, or the jetties, by the great earthquake wave of August 16th, 1868, although the sea receded so as to lay dry a great portion of the harbour; and it might have been reasonably expected that the removal of the pressure upon the ground in front of the sea-wall would have been accompanied by the subsidence of the station ground. The breakwater was still in progress by prison labour.—The second paper, on Ocean Steam Navigation, with a view to its further Development, by Mr. John Grantham, Memb. Inst. C.E., was read in part, and it was announced that it would be resumed at the next meeting.

EDINBURGH

Naturalists' Field Club, November 30.—Annual Meeting. The retiring president, Mr. Brown, delivered an address on the Education and Ethics of a Naturalist.—The following officers were then elected for the ensuing session:—Mr. R. Scot-Skirving, president; Mr. A. Craig-Christie, vice-president; Mr. Andrew Taylor, Lecturer on Geology, hon. treasurer and secretary; Drs. Black, McBain, R.N., Richardson, and Cameron, and Messrs. Brown, Sadler, Jackson, Panton, C. W. Peach, Herbert (Trinity), Kannemyer, and Archer, council. The club recorded its thanks to Mr. Thomas Edmonston, the late secretary, for his services. Miss Phœbe Blyth, of Abbotsford Park, was admitted without a ballot, and on a ballot the following gentlemen were elected members:—Lieut.-Colonel Rankin (Trinity), Dr. H. W. Nachot, and Messrs. Leitch and Macfie. The annual dinner took place the same evening, the president in the chair.

DUBLIN

Royal Geological Society of Ireland, December 8.—On this date a joint meeting of the fellows of this society and of the fellows of the Royal Zoological Society was held in one of the lecture-rooms of Trinity College, Sir Dominic Corrigan, Bart., in the chair. The Rev. Prof. Haughton read a paper on the Comparative Mechanism of the Flexor Tendons of the Feet and Hands in Mammals, Birds, and Reptiles; Prof. Traquair read a paper on *Griffithides mucronatus*, McCoy.

Institution of Civil Engineers of Ireland, December 8.—Mr. J. Ball Greene, president, in the chair. Mr. J. Price read a paper by Mr. W. Anderson, one of the ex-presidents, entitled "Record of some Experiments on Heating Water and on Condensing Steam by tubular and double-cased vessels."

MANCHESTER.

Literary and Philosophical Society, November 16.—J. P. Joule, LL.D., F.R.S., president, in the chair. Professor Osborne Reynolds, B.A., of Owens College, was elected an ordinary member of the society. A communication by Mr. E. W. Binney, F.R.S., F.G.S., on the Permian Strata of East Cheshire, was read. The author questioned the correctness of the Government map of the district lying between Macclesfield and Stockport, as far as regards the so-called "red rock fault," by which the coal measures are supposed to be bounded on their dip. According to his observations there is no more evidence of a fault between Macclesfield and Stockport, where the trias and permian beds cover the coal measures, than is to be found on the eastern side of the *Pennine* chain between Sandyacre and Sunderland, where carboniferous strata disappear under permian.—Professor Roscoe, Ph.D., F.R.S., communicated a paper on the Combinations of Phosphate of Lime and Sulphurous Acid, by Dr. B. W. Gerland, of Macclesfield. Phosphate of lime, in whatever state it may be, readily dissolves in an aqueous solution of sulphurous acid. The solution can be obtained of great strength: thus, from freshly precipitated tribasic phosphate of lime a liquor was prepared of 1·3 specific gravity, and from bone ash one of 1·708 specific gravity. The former, on analysis, gave results which agree tolerably with the formula $3CaO, PO_5, 6\,SO_2$. The solution of bone ash in sulphurous acid of 1·1708 specific gravity was also found, on analysis, to contain the amount of phosphoric acid required by that formula. The solution of phosphate of lime in sulphurous acid possesses the taste and smell of the acid, but to a much smaller extent than an aqueous solution of the acid containing the same amount of sulphurous acid. Under the influence of boiling heat the phosphate solution is decomposed slowly, sulphurous acid escapes, and a heavy white crystalline precipitate is formed. Under the microscope this appears to be composed of crystals of the hexagonal system, like those of rock-crystal. Washed and dried over sulphuric acid, it gave, on analysis, results agreeing with the formula $3CaO, PO_5, SO_2, 2HO$. This sulphited phosphate of lime has no smell or taste, and is distinguished from all sulphites by its stability. Heated in an air bath for three hours to 130° C. it lost 0·64 per cent. of water, but the amount of sulphurous acid remained unchanged; neither had a humid atmosphere the slightest effect upon it. The water is held in intimate combination, and is only expelled at a higher temperature when it is accompanied by fumes of sulphuric and sulphurous acids. The residue contains, besides lime and phosphoric acid, sulphate and sulphide of calcium. The sulphite, which withstands the action of the atmosphere indefinitely, is rapidly oxidised when incorporated with soil. In the soil it acts as a soluble phosphate of lime. It has in fact for several seasons been used as manure, and has given great satisfaction. The new sulphite possesses remarkable antiseptic and disinfecting powers, and on this account will command a general interest. The efficacy of sulphurous acid as a disinfectant is well known; it would be more appreciated if it could be conveniently applied. The aqueous solution is expensive by transport, it is very changeable, and in many cases it is unavailable on account of its pungent smell: whilst for medical purposes it can only be used in exceptional cases, in consequence of its irritating action. The sulphites are still more changeable. Exposed to the air they are acted upon by carbonic acid and by oxygen, and when mixed with decaying organic matter for disinfecting purposes they very often increase the mischief, and sometimes cause an abundant escape of sulphuretted hydrogen. The compound of phosphate of lime with sulphurous acid has none of these disadvantages. Acids, as well as ammonia, are neutralised by it. From a sanitary point of view, ammonia is particularly objectionable; being a product of putridity it helps to accelerate it, and also serves as a vehicle for disseminating other products, which, without it, would not be volatile, or only so to a less degree. The sulphited phosphate, when applied to putrid matter, will probably do its first service by neutralising the ammonia present (including compound ammonias), and also prevent its further formation, as the test paper will show. The smell will soon cease, or at least be greatly diminished and altered, and the mass will be safe for a long time, so that it may be removed or dried without danger or inconvenience. Dr. Gerland remarked that large quantities of putrid matter in open spaces are more completely and speedily disinfected by small portions of the phosphate, than samples in glass bottles. The compound recommends itself as a disinfectant by its physical properties. It is a clean white powder, which stains and soils nothing, dusts off garments or carpets, leaving no mark; it is free from smell and taste, and harmless to animal life. The solution of phosphate of lime in sulphurous acid also possesses disinfecting powers, and acts in many cases even with greater energy than the powder. It might be used with advantage as being applicable to places which could not be reached by the other. The neutrality, regularity of composition, utter harmlessness, and freedom from smell and taste recommend the sulphited phosphate of lime for trial in therapeutics. It would be of interest to investigate it in relation to putrid puerperal fevers, pyæmia, &c.

Microscopical and Natural History Section, November 8.—Joseph Baxendell, F.R.A.S., vice-president of the Section, in the chair.—Mr. W. J. Rideout presented the Section with one of the "Diotamaceen Typenplatte" prepared by J. D. Möller, of Holstein.—Mr. J. B. Dancer sent for the inspection of the members a young cuckoo, which had been caught by a cat in his garden, Old Manor House, Tipping Street, on the 19th August.—The following note was read from Mr. Joseph Sidebotham:—"About fifteen years ago, I had a large cabinet made, of forty-five drawers, to contain shells and carpological specimens, the drawers being made of pencil cedar. Very soon I found that the resinous vapour from the wood became deposited on some of the fruits and shells, making them appear as if they had been dipped in varnish. Chloroform appeared to be the only solvent, and the specimens were obliged to be washed with it. This became so bad that I had the whole of the drawers removed, and replaced with drawers of baywood. Some time afterwards, Mr. Carter advised me to have the cedar drawers sized and papered inside, and a new cabinet made to contain them: accordingly he made

me one to contain thirty drawers. These drawers were exposed to the air for twelve months, and very well sized inside, and papered, but the resinous vapour is still deposited on the objects in the drawers as before, and so far is a warning to every one never to use pencil cedar for such a purpose. I should not, however, have thought this matter worthy of mention before the Section, had it not been for the very curious and capricious way in which some objects are coated with this resin, while others are left entirely free, and for which I am totally unable to account. In shells the genera *Conus* and *Oliva* are never touched by it, nor are *Cyprea* or *Mitrea*, whilst *Helix*, *Bulimus*, and *Fecten*, are coated over: this is the case when there are specimens of these and other genera in the same drawer. As this deposit is on the genera I have named, and never on the others, it would seem to indicate that the texture of some shells would attract the vapour and not others. But in the case of bird's eggs, the very strange manner in which some species are picked out as it were and others left, is most remarkable. In the owl's eggs, for substance, the barn owl is always free, while the tawny owl is covered with the varnish, although side by side. The song thrush is never attacked, and the missel thrush always." Trays exhibiting these peculiarities were passed round for inspection.—Mr. Sidebotham also sent a living Death's Head Moth, bred from a pupa, which he had obtained at Lytham, and exhibited that the members might hear its curious cry or squeak when touched.—Mr. H. A. Hurst deposited in the Library a copy of a rare botanical work by a Jesuit priest, the Rev. J. Barrelier, which contained upwards of thirteen hundred carefully engraved plates of plants, which he had collected in France, Spain, and Italy. The work was edited by Antonio de Jussieu, and published in Paris in 1714. Mr. Hurst also exhibited some dried plants, recently collected by Mr. Wanklyn in the Southern States of America. Mr. Coward exhibited species of Podostemaceæ, collected by Gardner, in India and Ceylon. The Podostemaceæ, a little-known order of Tropical Aquatics, closely resemble the Liverworts in habit and general appearance, but possess phanerogamous flowers and dicotyledonous seeds. The order was placed by Von Martius amongst Endogens, in the near neighbourhood of the Naiadaceæ, and by Lindley in his Rutal Alliance of Exogens. Gardner considers it to be nearly allied to the pitcher plants, Nepenthaceæ. The difficulties attending the position of the order were well illustrated in the specimens exhibited, which presented a singular resemblance in foliation to Jungermannia and Riccia, and in the first view of the pedicillated ribbed capsule to the fructification of a moss, but in essential characters the true place appeared to be amongst the aquatic Endogens, with the anomaly of possessing a dicotyledonous seed.

November 30.—The Rev. William Gaskell, M.A., vice-president, in the chair. Mr. J. B. Dancer, F.R.A.S., communicated a paper on the Microscopical Examination of Milk under certain conditions, giving the results of observations made with the view of checking those of M. V. Essling, who states that vegetable organisms, like those found in putrefying substances, make their appearance in milk, before the milk gets sour. On examining a sample of unadulterated milk, Mr. Dancer was unable to detect the appearances described by Essling. The smallest oil globules exhibited as usual great molecular activity, but there was no appearance of dotted matter, or any fungoid growth when the milk was examined by powers varying from 200 to 1,500. A bottle was filled with some of this milk and securely corked; other portions of the milk were placed in open cups: one cup was kept in a cabinet which was closed during the day; the milk of the second cup was placed in a closet, the atmosphere of which was known to be favourable to the growth of fungi, the *Mucor Mucedo* being the most abundant and of the same family as that mentioned as having been found in cream by M. V. Essling. The milk in the bottle and that in the cups was examined daily, precautions being taken to close the bottle speedily after a portion was removed. On the third day the milk in the open cups was sour to the smell, but no change appeared visible under the microscrope; the upper portion of the milk in the bottle had become very rich in oil globules by the formation of cream. On the fourth day the casein had coagulated in the milk in the open cups, and the flaky precipitate was visible under the microscope; the pellicle surrounding the oil globules now appeared to be very easily ruptured, and with the slightest pressure some of the globules could be joined together—sometimes a number of globules which had been ranged in line by a current would coalesce by a slight movement of the fluid, and form an elongated mass. Fifth day, no appreciable alteration. Sixth day, the milk which had been placed in the closet had patches of mould visible on its surface: a microscopical examination of this mould showed it to be the *Mucor Mucedo*, such as had been frequently found on fruit which had been left in this closet. The fungus appeared on the surface only, no trace of it could be found in the milk taken from various depths. The milk in the cup kept in the cabinet exhibited no appearance of the *Mucor Mucedo* or any other vegetable or animal organism; it had become thickened into a pasty mass with an intensely sour odour. These observations were continued for eleven days, and the only difference observable was in the oil globules—they began to lose their spherical form, as if the investing pellicle had been weakened in parts and had become expanded. These experiments were repeated with a second supply of milk, and the results were alike in both cases. The range of temperature during the experiments was from 45° to 63° Fahr. These experiments led Mr. Dancer to believe that vegetable organisms do not as a rule make their appearance in pure unadulterated milk unless it is exposed for some time to atmospheric influences; most probably the spores are supplied by the atmosphere. He, however, considered M. V. Essling's suggestion to bottle the milk very good, and thought that cream pans with covers would be a very great improvement on the open ones as at present employed, at the same time having due regard to the cleanliness of the apartment and vessels in which the milk is kept.

Brighton

Brighton and Sussex Natural History Society, December 9.—The president, Mr. T. H. Hennah, in the chair. A paper was read by Mr. C. P. Smith on the Gemmæ of Mosses. Besides the ordinary mode of generation from a spore, which gives rise to a *prothullus*, from which the perfect plant is developed, mosses have another mode of generation, by means of gemmæ or sprouts, which have been defined as loose granular bodies, capable of becoming plants. As yet, none of the *Pleurocarpi* or side-fruiting mosses have, in Britain, been found producing gemmæ, whose situation on the plant varies in different species. Thus, in *Tortula papillus*, which grows on trees in Sussex and elsewhere, and has a thick spongy nerve, the gemmæ are found in the upper parts of the inside of the leaf—the fruit of this moss is unknown except in Australia; *Didymodon gemmascens*, having the nerve excurrent, has the tip crowded with gemmæ; in *Tetraphis pellucida* they are in pedicellate clusters at the ends of separate stems; in *Bryum atropurpureum* they form tubercles or bulbs in the axils of the leaves. On the leaves of *Orthotrichum Lyellii* grow little strings of cells, which, presenting a confervoid appearance, were named *Conferva castanea:* they have, however, been demonstrated to develop into young plants of mosses. *Oncophorus glaucus* has a great number of cells forming a dense mass at the tip of the leaf: these in the damp season give rise to young plants, so that this moss is common in counties where it never fruits. The subject of the growth of gemmæ has not yet been thoroughly worked out: he purposed investigating the phenomena, when he hoped to have some new facts to lay before the society. The paper was illustrated by drawings and microscopical specimens prepared by Mr. Smith, and exhibited by the following gentlemen, the most striking of which were—by Mr. Hennah, *Mnium cuspidatum*, *M. Hornum*, *Polytrichum commune*, and *Neckera oligocarpa*, showing flowers; Mr. Smith, *Ceratodon purpureum* and *Cinclidium stygium*, showing peristomes, and *Ephemerum serratum*, with prothullus and young buds; Mr. Sewell, section of leaf of *Pottia cavifolia* and *Orthotrichum Lyellii*, with confervoid gemmæ on the leaves, the *Conferva castanea* of the early botanists; Mr. Wonfor, *Aulocomnion androgyum*, *Ulota phyllantha*, and *Tetraphis pellucida*, exhibiting gemmæ.

Paris

Academy of Sciences, December 6.—M. Andral communicated a memoir on the relation of the variations of the temperature of the human body to variations in the quantities of some constituent principles of the blood and urine. In this paper the author discussed the proportion to be observed between the temperature of the body taken under the axilla and the amount of fibrin, albumen, and globules contained in the blood, and that of urea eliminated by the kidneys. He treated of the comparative phenomena presented in various diseases.—MM. Bouillard and Becquerel remarked upon this communication. M. Faye communicated extracts from letters from MM. B. A. Gould and L. Respighi upon the solar atmosphere and promi-

nences, with some remarks upon them by himself. Mr. Gould's letter related to the luminous protuberances observed during the last eclipse. He referred them to the chromosphere, which he regarded as the general atmosphere of the sun, and he accepted the notion that they indicate a predominance of hydrogen in that region, but he inclined to ascribe to this a greater elevation than is generally given to it, especially as the Coast Survey Expedition had obtained photographs which show traces of it at an elevation of 7 minutes. Mr. Gould also remarked upon the evidence furnished by the perihelion distance of the comet of 1843.—M. Respighi's note referred to the relation between the protuberances and solar spots, and he stated that in the neighbourhood of the poles of the sun the protuberances are almost constantly wanting, that they are in close relation with the faculæ and spots, and that the faint shadows which appear upon the photosphere are due to the interposition of the materials of eruptions, which may persist for many days together.—M. C. Marignac presented a paper on the influence of water upon saline double decompositions, and upon the thermic effects which accompany them. He described the mode in which he experimented, and gave the following results:—The dilution of a solution causes a variation of temperature in either direction, which usually diminishes with the degree of dilution, but with sulphuric acid the increase of temperature is augmented by dilution. The mixture of solutions of two salts which do not decompose each other, generally gives rise to an evolution of heat less than that produced by the simple dilution of the solutions. When they can form a double salt, there is usually absorption of heat. The mixture of alkaline sulphates with sulphuric acid causes a considerable absorption of heat. With solutions of the alkaline bisulphates, the addition of water produces a considerable and increasing evolution of heat. The mixture of two saline solutions, or of a salt and an acid capable of decomposition without producing an insoluble compound, gives rise to considerable thermic effects, which, in some cases, at least, are increased by dilution. With mixtures, the result appears to be different according as the dilution is effected before or after the mixture of the solutions.—A note by M. H. Resal, on the relative movements of the water in the curved floats of Poncelet's water-wheel was read; as also a note by M. Bosscha in answer to observations made by M. Regnault upon a previous letter of the author's on the measurement of temperatures.—M. Lecoq de Boisbandeau presented a memoir on some points of spectrum-analysis, in which he confirmed Secchi's observations on the spectra of different parts of Geissler's tubes, and communicated his own remarks on the spectra of the aureola of the positive pole, of the blue light of the negative pole, and of the spark itself. He also remarked upon differences caused by alterations in the conditions under which the spark is produced.—M. J. L. Soret communicated a note on the illumination of transparent bodies, in which he maintained, in opposition to M. Lallemand, that this is to be ascribed to suspended particles, especially in water. He described some experiments made by him. M. Chevreul in remarking upon this communication, noticed the decomposition of glass by water even at a temperature of 98° C. (= 208, 4° F.), and referred to the action of other bodies upon glass.—M. J. Maumené presented a reply to M. Dubrunfaut's note on inverted sugar, and M. Dubrunfaut a notice of his investigations of the catalytic phenomena presented by the action of acids upon crystallised sugar by the examination of the rotatory properties of its products.—M. A. Petit communicated a note on the sugar normally contained in wine, in which he stated that he had found in all wines a quantity of sugar varying from 0·50—5 grammes per litre. Sugar also occurs in vinegar.—M. Sanson, in a note on the caballine species of the genus *Equus*, endeavoured to show that our domestic horses belong to eight distinct species.—A memoir on the chemical composition of fossil bones by M. Scheurer-Kestner was presented by M. Milne-Edwards. The author remarked upon the conversion, in fossil bones, of a portion of the ordinary osseine into soluble osseine, and showed by analysis that the per centage of the latter is, *cæteris paribus*, equal in bones of the same date, so that its amount may furnish an almost infallible proof of the contemporaneity or otherwise of bones found together in the same cave or deposit. M. Elie de Beaumont made some remarks on this communication.—Notes were communicated by M. Ruffner on the preservation of meat by sulphurous acid, and on various questions of hygiene, and by M. Coffin on the "metaphysics of the differential calculus;" of these the titles only are given.

DIARY

THURSDAY, DECEMBER 16.

ROYAL SOCIETY, at 8.30.—Researches into the Constitution of the Opium Bases. Part III. On the Action of Hydrochloric Acid on Codeia: A. Matthiessen, F.R.S., and C. Wright.—On the Thermodynamic Theory of Waves of Finite Longitudinal Disturbance: Prof. Rankine, F.R.S.—On Approach caused by Vibration: Prof. Guthrie.

SOCIETY OF ANTIQUARIES, at 8.30.—On the Descent and Arms of the House of Compton: Mr. Evelyn Philip Shirley, F.S.A.

LINNEAN SOCIETY, at 8.—On a species of *Ipomœa* yielding Tampico Jalap: Daniel Hanbury, F.R.S.

CHEMICAL SOCIETY, at 8.

ZOOLOGICAL SOCIETY, at 4.

NUMISMATIC SOCIETY, at 7.

PHILOSOPHICAL CLUB, at 6.

LONDON INSTITUTION, at 7.30.—Architecture: Prof. R. Kerr

EDINBURGH GEOLOGICAL SOCIETY, at 8.

FRIDAY, DECEMBER 17.

PHILOLOGICAL SOCIETY, at 8.15.

QUEKETT MICROSCOPICAL CLUB, at 8.

MONDAY, DECEMBER 20.

MEDICAL SOCIETY, at 8.

ROYAL ASIATIC SOCIETY, at 8.

LONDON INSTITUTION, at 4.—Elementary Physics: Prof. Guthrie.

INSTITUTE OF ACTUARIES, at 7.

SOCIETY OF ARTS, at 8.—The Spectroscope and its Applications: Mr. J. Norman Lockyer, F.R.S.

TUESDAY, DECEMBER 21.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Anniversary Meeting.

STATISTICAL SOCIETY, at 8.

PATHOLOGICAL SOCIETY, at 8.

ETHNOLOGICAL SOCIETY, at 8.—On an Ancient Calvaria, assigned to Confucius: Prof. Busk, F.R.S.—On the Koords and Armenians: Major Millingen, F.R.G.S.—On the Kitai and Kara-kitai: Dr. Gustav Oppert.

WEDNESDAY, DECEMBER 22.

SOCIETY OF ARTS, at 1.—On Wines—their Origin, Nature, Analyis, and Uses; with special reference to a new Alcoholic Drink made from Tea: Dr. J. L. W. Thudichum.

GEOLOGICAL SOCIETY, at 8.—On the Iron-ores associated with the Basalts of the North-east of Ireland: Mr. Ralph Tate, F.G.S., and Dr. J. S. Holden, F.G.S.—Note on the Skull of the Large Kimmeridge Crocodilian, *Dakosaurus maximus*, Buenstedt, *Steneosaurus*, Geoffr. St. Hilaire: Mr. J. W. Hulke, F.R.S.—Note on a fragment of a Jaw with peculiar Teeth from Kimmeridge Bay: Mr. J. W. Hulke, F.R.S.—Notes on the Structure of *Sigillaria*: Principal Dawson, F.R.S. of Montreal.—Notes on some new Animal Remains from the Carboniferous and Devonian of Canada: Principal Dawson, F.R.S.

THURSDAY, DECEMBER 23.

SOCIETY OF ANTIQUARIES, at 8.30.

BOOKS RECEIVED

ENGLISH.—Home Life of Sir David Brewster: By his daughter, Mrs. Gordon (Edinburgh: Edmonston and Douglas):

FOREIGN.—Histoire de la Création: par H. Burmeister; traduite de l'allemand: E. Maupas.—Monographie des Ligumineuses Cæsalpinées: H. Baillon.—Die Nordamerikanische Zuckerfabrikation aus Sorgo und Imphy: Dr. Karl Löffler und Peter von Papi-Balogh.—Untersuchungen über Bau und Entwicklung der Arthropoden: Dr. Anton Dohrn.—Ueber die Bauweise des Feldspaths: Dr. Fredrich Scharff.—Japanisches Meeres-Conchylien: Dr. C. E. Lischke.—Die Pflanzenstoffe: Dr. Aug. Husemann und Dr. Theod. Husemann.—Die Lagerstätten der Nutzbauren Mineralien: Johann Grimm.—Archiv fur Mikroskopische Anatomie: Max Schultze.

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ERRATUM.—Line 26, col. 2, p. 166, should read as follows: "total number about 200. I have identified at least 60"

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